View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

provided by University of Saskatchewan's Research Archive

Macro and micronutrient content of foods served to 3-5-year-old children before and after pulse intervention and factors influencing the sustainability of pulse-based foods in Saskatoon childcare centres

A Thesis Submitted to the College of Graduate and Postdoctoral Studies

in Partial Fulfilment of the Requirements for the Degree of Masters of Science

in the Division of Nutrition and Dietetics of the College of Pharmacy and Nutrition

University of Saskatchewan

Saskatoon

By

Rana Jazeri

© Copyright Rana Jazeri, July 2019. All rights reserved

Permission to Use

In presenting this thesis in partial fulfillment of the requirements for a postgraduate degree from the University of Saskatchewan, I agree that the libraries of this university may make it freely available for inspection. I further agree that permission for copying of this thesis in any manner, in whole or in part, for the scholarly purpose may be granted by the professor or professors who supervised my thesis work or, in their absence, by the Dean of the College in which my thesis work was done. It is understood that any copying or publication or use of this thesis or thereof for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and to the University of Saskatchewan in any scholarly use which may be made of any material in my thesis.

> Requests for permission to copy or make other use of material in this thesis in whole or part should be addressed to:

Dean of Pharmacy and Nutrition
University of Saskatchewan
104 Clinic Place
Saskatoon, Saskatchewan
Canada S7N 2Z4

OR

Dean of the College of Graduate and Postdoctoral Studies
University of Saskatchewan
116 Thorvaldson Building, 110 Science Place
Saskatoon, Saskatchewan S7N 5C9, Canada

Abstract

This study examined pre and post-intervention macro- and micronutrient content of regular and pulse-based intervention meals served to 3-5-year old (yo) children at four Saskatoon childcare centres (CCs); and factors, which are perceived as important for the adoption, implementation, and continuation of a pulse-based nutrition education intervention at CCs. The Pulse Discovery Tool Kit (PDTK) was an intervention introduced into four CCs in Saskatoon in order to promote pulse-based foods. In the present multi-methods study: quantitative analysis of macronutrient and micronutrient content of thirteen regular menu items and four pulse-based intervention recipes was carried out; as well as an analysis of plate waste data obtained previously that measured food preferences of 3-5 yo children. The following macro- and micronutrients were measured: calories, carbohydrates, fats, saturated fats, proteins, sodium, total fibre, calcium, folate, iron, magnesium, potassium, zinc and the vitamins A and C. The results for the macro- and micronutrients were calculated for 100g of each type of food. In addition, qualitative data was obtained from school staff one year following to determine the sustainability of the PDTK intervention.

Results showed that pulse-based foods provided fewer calories, similar amounts of protein and carbohydrates, higher fiber, lower fat and unsaturated fats, and similar amounts of micronutrients such as calcium, iron, magnesium, potassium, sodium, zinc, folate and the vitamins C and A. With respect to plate waste, it varied from a low of 5.4% for beef tacos and a high of 78% for ranch dip. Generally, the plate waste was higher for the pulse-based foods as compared to the regular foods. This indicated that the children did not like the pulse-based foods, perhaps because they were not familiar with pulses and due to a reluctance to try a novel food. The staff interviews revealed six themes: knowledge of the CC food guidelines; length of time it took to cook the

recipes; the effort in preparing the pulse recipes; price of the pulses; fatiguing the children with too many pulse-based foods; and the difficulty in having the kids eat the PDTK recipes. It was found that the staff were generally aware of the provincial and federal guidelines for foods served to children at CCs. However, all of the cooks, and some directors, felt that the pulse-based food recipes were time-consuming and too complex to make. Price was not seen as a factor in the serving of pulses in CCs. However, all of the staff were wary of fatiguing the children with too many pulse foods and noted that the children, on the whole, did not like eating the pulse foods. The reasons for this, according to the staff, were due to pulses being novel and the texture of the pulse-based foods. Although the cooks at the CCs used small amounts of pulses in some of their foods, they did not make any of the pulse foods that were made during the PDTK intervention. Overall, this study revealed that pulses are an excellent plant-based alternative to meats and other food sources, and are in line with the recommendations of Health Canada's food guidelines. However, the recipes used in the intervention were time consuming and not liked by the children, as evidenced by the food wastage data. Therefore, other recipes, which are less time consuming and more liking to the children, should be explored.

Acknowledgements

I would like to express my special gratitude to my Supervisor, Dr. Carol Henry, who gave me the golden opportunity to do this project. I am also indebted to my advisory committee members, Dr. Susan Whiting, Dr. Brian Bandy, Dr. Hassan Vatanparast, for their generous support, coaching, companionship, and mentoring during the course work.

My thanks and appreciation also to The Libyan Ministry of Higher Education & Scientific Research and the University of Saskatchewan for their financial support.

.

Dedication

I dedicate this thesis to my mother and father, without whose endless support, care, love, optimism, generosity and patience, I would not be the person I am.

Table of Contents

List of Tables

List of Figures

List of Acronyms & Abbreviations

ANOVA	Analysis of Variance
BMI	Body Mass Index
CFG	Canada's Food Guide
CVD	Cardiovascular Disease
CC	Childcare Centre
DRI	Daily Reference Intakes
DFE	Dietary Folate Equivalents
DOI	Diffusions of Innovations
GI	Glycemic Index
IU	International Unit
PDTK	Pulse Discovery Tool Kit
RDA	Recommended Dietary Allowance
SCNG	Saskatchewan Childcare Nutrition Guidelines
SFE	School Food Environment
SFs	Saturated fats
SPSS	Statistical Package for Social Science
USDA	United States Department of Agriculture
WHO	World Health Organization
Yo	Year Old

CHAPTER 1: INTRODUCTION

Although children are strongly influenced by their parents when it comes to dietary behaviours (Clark, Goyder, Bissell, Blank, & Peters, 2007), the majority of Canadians rely on CCs to feed and attend to their children while they are at work. In 2011, 54% of Canadians sent children who were four years old or younger to Childcare Centres (CCs) while it was 46% for children 14 years old (yo) or younger (Sinha, 2014). On average, the children are spending a minimum of 30 hours a week in daycare (Sinha, 2014). The situation in the United States is similar to that of Canada with 58% of parents indicating that their four to five-year-old children were in a CC prior to attending kindergarten (Rathbun & Zhang, 2016).

The types of foods the children are provided in CCs are highly varied. In Canada, it has been recommended that children who attend full-time childcare should be consuming approximately one third of their daily macro- and micronutrient requirements, or their Canadian Daily Reference Intakes (DRI), for lunch (Gougeon, Henry, Ramdath, & Whiting, 2011; Romaine, Mann, Kienapple, & Conrad, 2007). In Canada, the DRI values, from infants to adults, are determined by Health Canada and are changed based on new literature and research (Health Canada, 2016). The primary parameter used, besides others, to establish the DRI guidelines is for reducing disease risk due to the lack of a micro or macro-nutrient. The recommended dietary allowance (RDA) for males and females and is based on an individuals' life-stage and is sufficient to meet the requirements of 97.5% of healthy people (Health Canada, 2011). For the most part, the provincial governments, including in Saskatchewan, follow the Canadian DRI and the Canada Food Guide (CFG) guidelines established by Health Canada and use these to recommend the food groups and serving amounts that should and should not be given to children in CCs (Government of Saskatchewan, 2008). In January 2019, however, a new CFG was

introduced (Government of Canada, 2019). Amongst the major changes are the elimination of the traditional four food groups, vegetables and fruit, grain products, milk and meat to one consisting of three: vegetables and fruits, whole grains (such as whole grain pasta) and protein foods (such as lentils, poultry, fish, lean red meat, milk, cheese, and various others), and water as the choice of drink. A further change is that the CFG emphasizes more eating of plant-based protein. Moreover, guidelines for the portion or serving size have also been eliminated. Given the newness of the CFG (2019), its recommendations have yet to be introduced into provincial guidelines for CCs.

Although there are guidelines, researchers have found that not all CCs follow, or even know about, the guidelines. For example, Gougeon et al. (2011), analyzed, from 1997-2007, breakfast and lunch foods served to children aged 4 to 8 years in Saskatchewan elementary schools. They found that over the decade the meals were low in energy, fibre, and potassium but that the levels of vitamin A, C and folate increased over the study years. In addition, the levels of sodium and sugars were above the DRI standards (Gougeon et al., 2011). A recent Canadian study investigated the nutritional composition of lunches served to children in CCs in two Canadian provinces, Saskatchewan and New Brunswick. The authors reported similar results to Gougeon et al., revealing that lunches were low in calories and fibre and high in sodium and sugar (SA Ward et al., 2016). Both studies indicated that lunches provided to children in most CCs did not meet the DRI recommendations.

Similar to Canadian studies, findings in the USA have indicated that children are receiving inadequate nutrition at CCs. Padget, & Briley (2005) studied nine CCs in Texas and found that the children's DRI was insufficient in grains, dairy and vegetables. A similar study examined the feeding menus and conducted a one-time visit of 24 CCs in Georgia and reported

that the menus were high in saturated fat and sodium and inadequate in iron and fibre (Maalouf, Evers, Griffin, & Lyn, 2013). On the day of the observation, the authors found that no vegetables were served, 13 centres provided no whole grain food, and 19 served high sugar and/or high-fat foods. Considering the importance of nutrients in children's early development, many CCs are not providing sufficient amounts macro- and micronutrients to children, and in some cases, are exceeding the energy requirements and thus may be contributing to the risk of obesity in these children (Collins, Jane, & Burrows, 2009).

Given that children are spending a third of their day in childcare facilities, and that the meals provided to them are often inconsistent in quality and fail to meet the DRI of macro- and micronutrients, it is important that children be provided adequate and varying amounts of nutritious foods in this critical phase of their growth and life. While there has been a considerable amount of work on the bulk intake of macronutrients by pre-school children, the micronutrient intake has been less well studied (Frampton et al., 2014). It is well known that nutrient deficiencies during childhood can stunt normal physical and cognitive development which, in some cases such as iron deficiency, cannot be reversed with a sufficient diet in later life (Benton, 2010). In the present study, the amounts of the following macro and micro-nutrients in the foods served to children in the CCs were examined: calories, proteins, carbohydrates, fats, saturated fats, total fibre, calcium, folate, iron, magnesium, potassium, sodium, zinc and the vitamins A and C.

One of the most nutritious dietary staple in the world are pulses, and they are comprised of peas, beans, lentils and chickpeas. Strictly speaking, pulses only refer to the dried edible seeds of the legume plant family so that green and fresh beans, peas, soybeans, and peanuts are not considered pulses (Figure 1.1) (Pulse Canada, 2016). While pulses are relatively inexpensive as

compared to dairy and meat products, there has been a global decrease in its consumption (Akibode & Maredia, 2012). The largest producer and consumer of pulses is India, with Canada accounting for 35% of the global production of lentils and peas (Pulse Canada, 2016). The majority of pulses produced in Canada are grown in Saskatchewan (Pulse Canada, 2016). Nutritionally, pulses are excellent sources of plant-based proteins and amino acids, fibre, micronutrients, mono, and polyunsaturated fats, and carbohydrates (Mudryj, Yu, & Aukema, 2014). Furthermore, some other benefits of pulses are that, when digested, their carbohydrate are released slowly so that they do not raise the glucose content in blood as quickly as do sugars and other food types and therefore are low on the glycemic index (GI). The latter factor is believed to be extremely helpful in the prevention and management of obesity, type-2 diabetes, and metabolic syndrome (Rebello, Greenway, & Finley, 2014). Considering the benefits of pulses as compared to other food types, pulses should be an ideal food type which can be added to meals offered at CCs.

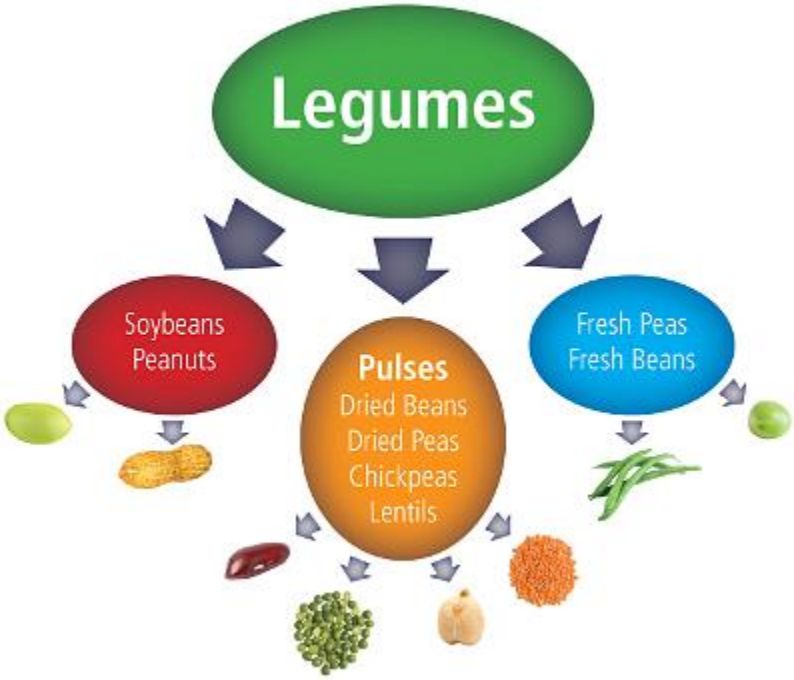


Figure 1.1: The legume family.(Pulse Canada, 2016).

Given the variability in foods provided to children in CCs, as well as the nutritious aspects of legumes, a study was conducted where the regularly provided CC foods were replaced with legume-based foods. The intervention of promoting pulse-based foods in Saskatchewan CCs was conducted as a nutrition education intervention and named the Pulse Discovery Tool Kit (PDTK) (Ramikie & Haileslassie, 2017). The PDTK nutrition education intervention offered an opportunity to study and compare the macro- and micronutrient profile of foods provided to children both prior to and during the PDTK. It also offered the opportunity to understand the extent to which the PDTK nutrition education intervention can lead to change in the practice and behaviour of CC staff beyond the intervention period. Thus, the study examined factors that are perceived as important for the adoption, implementation, and continuation of the pulse-based menu beyond the intervention.

1.1. Pulse Discovery Tool Kit (PDTK) Nutrition Education Intervention

The PDTK nutrition education intervention was implemented as a two year, multi-centre, school-based primary prevention program designed to promote the consumption of pulses among 3-5 years old in CCs in Saskatoon. The foodservice element of the PDTK intervention was one of two components (curriculum changes was the other), and was established by incorporating pulse-based meals into the existing centres' menu. The study was divided into three phases. Phase I - Preparation phase was carried out between June 2015- February 2016, and included recipe testing, product development, and the development of the PDTK nutrition education resource manual. Pretesting was carried out in one CC, which was not part of the intervention. Phase II – Implementation phase was conducted between March 2016- September 2016 and assessed acceptability and feasibility of implementing the PDTK in two CCs in Saskatoon (Phase

I & II are completed and have been reported elsewhere). Phase III – Roll-out of the PDTK nutrition education intervention occurred from October 2016- April 2017 in four CCs in Saskatoon. The main objective of Phase III was to examine the effectiveness of the PDTK nutrition education intervention in changing knowledge, preferences, and practice among children and staff in the four CCs.

The present study, "***Macro and micronutrient content of foods served to 3-5-year-old children before and after pulse intervention, and factors influencing the sustainability of pulse-based foods in Saskatoon childcare centres"***, builds on the work completed in Phase III of the PDTK nutrition education intervention.

1.2 Purpose, Objectives, and Significance of the Study

1.2.1 Purpose of the Study

The present study sought to examine pre and post-intervention macro- and micronutrient content of the meals served to 3-5-yo children at four Saskatoon CCs. The second goal of this study was to examine the factors which are perceived as important for the adoption, implementation, and continuation of a pulse-based nutrition education intervention at CCs.

1.2.2. Objectives of the Study and Statements of Hypotheses

To achieve the above-mentioned purposes, the following objectives were set:

- ***Objective 1:*** to determine and compare the intervention meals vs. the regular selected meals in terms of macro- and micronutrient profile served to 3-5-year-old children at CCs.
- ***Hypothesis for objective 1:*** enhancing the meals with pulse-based foods will result in an improvement in the macro- and micronutrient content of foods as compared to the pre-intervention meals at four Saskatoon CCs.
- ***Objective 2:*** to determine and compare the total grams of leftover food (plate waste) in both pre and post-intervention meals at CCs.
- ***Hypothesis for objective 2:*** children prefer the pulse-based foods, and therefore there will less plate waste as compared to the regular meals.
- ***Objective 3:*** to explore factors that influence adoption, implementation and continuation of a pulse-based nutrition education intervention (PDTK) in the meals served in CCs in Saskatoon.

1.2.3 Significance of the Study

Maximizing the nutritional value of meals is often secondary to the CCs permission to provide calories, especially given limited financial resources. Childcare environments have gained high marks for stimulating early development of social skills (Peisner-Feinberg et al., 2001), yet what children eat in preschool institutions has only recently become a topic of dietary interest (Maher, Li, Carter, & Johnson, 2008). Within this context, assessment of the nutrient adequacy of CC menus and of whether the dietary needs of this population are being adequately met is of critical importance, especially in view of the relevance of childhood diet to the maintenance of proper nutritional status (Barbosa, Carvalho, Franco, Salles-Costa, & Soares, 2006), as well as their health status once they reach adulthood (Lakshman, Elks, & Ong, 2012).

In addition, poor dietary habits contribute to increasing overweight and obesity. This is likely to jeopardize growth and development during childhood. Children spend a large part of their day in CCs. Therefore, CCs have the opportunity to shape children's eating habits by role modeling healthy eating behaviours, having a healthy attitude towards food, and by providing healthy meals and snacks. Findings from the present study will provide an important source of information for parents, school staff, researchers, and practitioners, and childcare regulators. Using the menu to assess the diet quality of actual meals served to children attending childcare will also help to identify opportunities for improvement through dietary interventions (Romaine et al., 2007). Additionally, food wastage data will provide a general baseline on food wasted by children, but specifically, provide data on whether pulse-based foods were preferred or not.

Lastly, the qualitative portion of this study offered the opportunity to understand the extent to which the PDTK intervention can lead to change in the practice and behaviour of CC

staff beyond the intervention period. Thus, we were able to examine factors that are perceived as important for the sustainability of the pulse-based menu beyond the intervention.

CHAPTER 2: LITERATURE REVIEW

This literature review was carried out to place the proposed study in the context of research that was done and the gaps in knowledge which the present work is undertaken to fill. The review will first discuss of the nutritional requirements for CCs in Saskatchewan; followed by an overview of CFG and the macro-and micronutrients such as protein, energy, total fibre, calcium, folate, iron, magnesium, potassium, sodium, zinc, and the vitamins C and A, and their role in children's development. The nutritional and health benefits of pulses as healthy options for children's diet is also reviewed, including: the reasons why nutritional interventions are or are not adopted or sustained at CCs; a discussion of possible consequences of unhealthy eating, such as childhood overweight and obesity; and plate waste to determine likes and dislikes of regular and PDTK meals. The section ends with the Canadian demographics of children in the age group being studied.

2.1 Nutritional Requirement for Childcare Centres- Saskatchewan

Saskatchewan Childcare Nutrition Guidelines (SCNG) follow the stipulation of Health Canada's Food Guide recommendation for pre-school children attending CCs (Appendix A) (Government of Saskatchewan, 2016). The guidelines stipulate that children must be provided snacks or a meal within three hours of attendance, and that some foods and beverages, such as pastries, cakes and cookies, granola bars, chocolate, doughnuts, ice cream, frozen desserts, potato chips, French fries, salty snacks, soft drinks, sports drinks, and fruit-flavored sweetened drinks, should be offered in limited quantities (Government of Saskatchewan, 2008). Additionally, the guide suggests that snacks should consist of two or more food groups and include a serving of fruit or vegetables, plus at least one other food group; breakfast is to consist

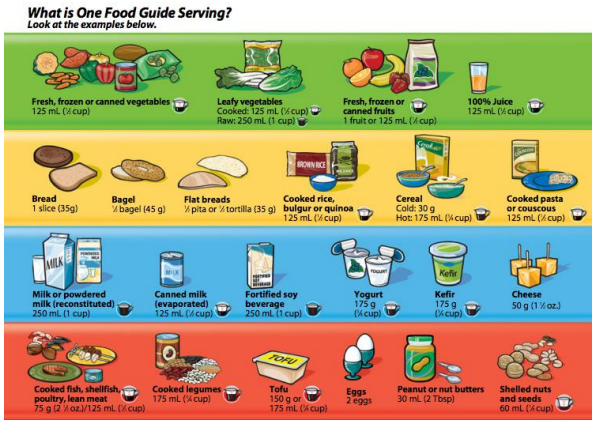
of, in designated amounts, three or more food groups; while all other meals consist of four food groups; and that milk should be offered at least twice a day. And that if juice is offered it should be 100% unsweetened and offered no more than three times a week. However, the guidelines do not stipulate the number of meals and snacks that should be provided to children only that nutrition be provided every two to three hours.

2.2 Eating Well with Canada's Food Guide (for Children Aged 2 and Older)

At the time the research was conducted, CCs in Saskatchewan followed the *Eating Well with Canada's Food Guide* (Katamay et al., 2007). These guidelines provided recommendations for the types and serving size references for each food group required for a child on a daily basis is. The guide provided caregivers suggestions on planning snacks and meals, which meet the DRI for children who are 2 years old or older. The guide underscores traditional foods for First Nations, Inuit, and Métis (Health Canada, 2010c) and is available in 12 different languages (Health Canada, 2013). In the guide, a rainbow of varying colours represents the four food groups, which are vegetables and fruits, grain products, milk and alternatives, and meat and alternatives. Other recommendations the CFG provided was serving size. Moreover, the guide further stresses "Foods to Limit", and these include food and beverages which are high in calories and low in nutrition and include: cakes and cookies, fruit-flavoured sweetened drinks, doughnuts, pastries, granola bars, chocolate ice cream, frozen desserts, French fries, potato chips, sports drinks, salty snacks, and soft drinks (Government of Saskatchewan, 2008).

In January 2019, however, a new CFG was introduced (Government of Canada, 2019). The new guide, which has not yet been adapted by CCs because it is so recent, has eliminated the four food groups, detailed above, to one consisting of vegetables and fruits, whole grains and

protein foods now include more of those which are plant-based, such as lentils. Milk, too, has been eliminated with the guide suggesting that people utilize more water rather than other types of drinks. Serving size has been eliminated as it was felt that most people do not weigh their food prior to consumption. The protein of choice recommendation are pulses, nuts, and tofu. Rather than serving size as in the previous guide, the emphasis now is on the proportion of foods with half consisting of vegetables and fruits, one-fourth of proteins consisting of little to no meat, and the remaining of whole grains (Figure 2.1).



a

b

Figure 2.1: The previous (a) and new (b) Canada Food Guide.

Images a (Health Canada, 2013) and b (Government of Canada, 2019).

2.3 Macro- and micronutrients and their role in children's development.

Considering the variability in meals provided to children in CCs, from lower than DRI fibre content to foods high in fat, protein, sugars, and carbohydrates, it is important to provide children a balanced and nutritious diet (Thompson & Brick, 2016). The lack of proper food consumption by children can lead to obesity, impaired physical and cognitive development, and increased risks for disease later in life (Needham, Dwyer, Randall-Simpson, & Heeney, 2007). A significant amount of research has indicated that a proper diet during the years from birth to five years of age lays the foundation for children's dietary behavior and activities in later life (Needham et al., 2007; D. S. Ward, 2010) (Table 2.1). During these years, a proper quantity and quality of nutrients are required for the children's optimal physical and cognitive development (Goldsborough, Homer, Atchinson, & Barker, 2016; Scaglioni, Arrizza, Vecchi, & Tedeschi, 2011). In Western countries, generally speaking, it is the excess of macro-and micronutrients which is the problem as, together with sedentary behaviour, children have become obese (Pabayo, Spence, Casey, & Storey, 2012; D. S. Ward, 2010).

Regardless, as noted, the macro- and micronutrients selected to be measured in this study were calories, proteins, carbohydrates, fats, saturated fats, total fibre, calcium, folate, iron, magnesium, potassium, sodium, zinc and the vitamins C and A (Appendix D). The lack of a nutrient, which provides a physiological stimulus for proper development, is not adequately provided, say by undernutrition, can be a lasting and sometimes irreversible effect on cognition and physiology (Prado & Dewey, 2014). As compared to many other foods, pulses are rich in protein. In fact, the recently released CFG stresses the use of plant-based protein and names pulses as a good alternative to meat-based diets (Government of Canada, 2019). In terms of carbohydrates, which are the direct source of energy to the body, pulses are known to lower

blood triglycerides and glycaemic load as compared to other grains and also have a much lower fat content as compared to other foods such as wheat (Venn et al., 2010). In terms of fats and saturated fats, pulses contain very little of both, and therefore, the reduction in obesity and other related cardiovascular diseases is obvious (Leterme, 2002). Fibre is one ingredient that people in Western countries are deficient in and health organizations have stressed its daily consumption. The use of fiber, which is plentiful in pulses, can help to reduce constipation, heart disease and diabetes (Gougeon et al., 2011; Papanikolaou & Fulgoni, 2008).

Table 2.1: Macro and micronutrients and their roles in children.

Nutrients	Role in children	Reference
Proteins	Growth, strength, and brain power, build and repair cells, enzymes, and hormones	Kolasa, K. (2012)
Carbohydrates	Source of energy	Kolasa, K. (2012)
Total fibre	Reduce constipation, heart disease and diabetes	Gougeon et al., (2011); Papanikolaou & Fulgoni, (2008)
Calcium	Bone formation	Kolasa, K. (2012)
Folate	Brain development	Patterson, Maskus, & Dupasquier. (2009)
Iron	Deficiency of iron linked to both cognitive and behavioural delays as well as anemia	Nead, Halterman, Kaczorowski, Auinger, & Weitzman. (2004)
Magnesium	Keep bones strong and the heart rhythm steady, supports the immune system, and helps maintain muscle and nerve function	Kolasa, K. (2012)
Potassium	Important for respiratory health, such as managing asthma	Berthon & Wood. (2015)
Zinc	Brain development, and contributes DNA and RNA synthesis, and its deficiency slows the growth	Prado & Dewey, 2014; Benton, 2010
Vitamin C	It's deficiency results in scurvy and can, in small children, lead to impaired brain development	Tveden-Nyborg & Lykkesfeldt, (2009)
Vitamin A	Important to the immune system and in controlling inflammation	Sommer A & West K. (2001)

In terms of micronutrients, pulses offer many advantages that other foods may lack. For calcium, the CFG has traditionally recommended milk and dairy as a good source (Health Canada, 2013). In the newest CFG the importance of milk and dairy is less prominent with soy, broccoli, kale and spinach being other sources of calcium (Government of Canada, 2019). Folate, which is important in brain development of children, also make pulses a food which is helpful to the proper development of children (Patterson, Maskus, & Dupasquier, 2009). Pulses are also a good source of iron, a deficiency of which in childhood is linked to both cognitive and behavioural delays as well as anemia (Nead, Halterman, Kaczorowski, Auinger, & Weitzman, 2004). Meanwhile, magnesium, potassium, and sodium are micronutrients whose role are especially important for respiratory health, such as managing asthma (Berthon & Wood, 2015; Kolasa, 2012). Zinc is the fourth largest component in the brain and contributes DNA and RNA synthesis (Prado & Dewey, 2014) and its deficiency slows growth (Benton, 2010). In terms of vitamins A, it is important to the immune system and in controlling inflammation and its deficiency can lead to the inability to cause infections, and therefore increase disease and morbidity (Sommer A & West K 2001). Lastly, vitamin C deficiency results in scurvy and can, in infants and small children, lead to impaired brain development (Tveden-Nyborg & Lykkesfeldt, 2009).

2.4 Macro and Micronutrients Found in Pulses

Despite pulses being one of the most affordable and nutritious of food grains, often referred to as the poor man's meat (Leterme, 2002), their consumption in Canada is limited (Jha et al., 2014). Pulses are an extremely rich and concentrated source of soluble and insoluble fibre, protein (17-30% dry weight), and are excellent sources for folate, magnesium, potassium, and iron (Table 2.2) (Thompson & Brick, 2016). Pulses are composed of 50%- 65% carbohydrates,

the sugars from which, during digestion, are released slowly into the bloodstream so that their glycemic index (GI) is low. On the GI scale, where glucose is ranked as 100, the GI of pulses is approximately 25 as compared to wheat pasta the GI of which is 45 (Foster-Powell, Holt, & Brand-Miller, 2002). This is the primary reason why pulses are so effective in managing type-2 diabetes (Leterme, 2002). Pulses are also good sources of mono and polyunsaturated fat, folate, riboflavin, lysine, thiamine, niacin, iron, zinc and the vitamins A and E (Mudryj et al., 2014). As noted above, the consumption of pulses can lead to decreased cancer, cardiovascular disease (CVD) and metabolic syndrome risks, and help in controlling obesity (Leterme, 2002). In fact, the versatility of pulses is demonstrated by the fact that the United States Department of Agriculture (USDA) has noted that servings of dry beans, peas and lentils can be counted in either the meat and bean food group or in the vegetable group (Leterme, 2002). As an example, daily consumption of a half cup of dry peas or beans can fulfill an adult daily requirement of fibre, iron, zinc, magnesium, folate, and protein while at the same time lower the intake of saturated fat and total fat (Table 2.2) (Mitchell, Lawrence, Hartman, & Curran, 2009). Lastly, the phytochemicals present in pulses may also be strong antioxidants, with the latter being associated with a reduction in cancer and other disease risks (Dahl, Foster, & Tyler, 2012)

Table 2.2: Nutritional content of select pulses[a].

Legumes	Serving size	Energy (kcal)	Carbo-hydrate (g)	Protein (g)	Fat (g)	Fibre[b] (g)	Folate (µg)	Ca (mg)	Fe (mg)	Mg (mg)	K (mg)	Na (mg)	Zn (mg)
Pinto beans	1/2 cup	122	22.42	7.70	0.56	7.7	147	39	1.79	43	373	1	0.84
Great northern beans	1/2 cup	104	18.66	7.37	0.40	6.2	90	60	1.89	44	346	2	0.78
Navy beans	1/2 cup	127	23.71	7.49	0.56	9.6	127	63	2.15	48	354	0	0.94
Black beans	1/2 cup	114	20.39	7.62	0.46	7.5	128	23	1.81	60	305	1	0.96
Blackeyes	1/2 cup	99	17.75	6.61	0.45	5.6	178	21	2.15	45	238	3	1.10
Kidney beans	1/2 cup	112	20.18	7.67	0.44	5.7	115	31	1.96	37	358	1	0.88
Chickpeas	1/2 cup	134	22.48	7.27	2.12	6.2	141	40	2.37	39	239	6	1.25
Split peas	1/2 cup	116	20.68	8.17	0.38	8.1	64	14	1.26	35	355	2	0.98
Lentils	1/2 cup	115	19.93	8.93	0.38	7.8	179	19	3.30	36	365	2	1.26

Adapted from (Rebello et al., 2014). [a]Values are for one cooked serving of mature dry legume seeds boiled without salt. [b]Does not include all of the resistant starch fractions.

2.5 Meals at Childcare Centres

What is the present status of the meals served at CCs? The results have been highly varied with the indication that the majority of CCs are failing to provide an adequate amount, or in some cases an excessive amount of carbohydrates and sugars, of macro- and micronutrients to children. This is highly problematic given the need for nutrients at this critical developmental stage of their lives, which not only are required for their physical but also their cognitive and social development. Considering the amount of time children spend at CCs, it has been recommended that children who attend full-time daycare should be consuming approximately two thirds of their daily macro- and micronutrient requirements while there (Padget & Briley, 2005) and that one third of the DRI should be met from foods consumed during lunch (Gougeon et al., 2011; Romaine et al., 2007).

A recent Canadian study researching iron deficiencies in Inuit pre-school children attending CCs in Nunavik found that 73% of the children were deficient while the rest were anemic (O'Brien, Blanchet, Gagné, Lauziere, & Vézina, 2014). Another study, conducted at nine CCs in Texas, found that the meals provided to children were insufficient in grains, dairy, and vegetables (Padget & Briley, 2005). A study conducted at 24 CCs in Georgia found that the menus were high in saturated fat and sodium and deficient for iron and fibre. Out of the 24 centres, 19 served foods high in sugar and/or fat, while 13 centres provided no food types which contained whole grain (Maalouf et al., 2013). While the menus themselves may lead parents to believe that their children are consuming nutritious meals at a CC, this may not always be the case as the meals actually provided may differ from those planned. This was the case in the Padget and Bradley (2005) study as the authors visited the CCs they were studying and found that although noted on the menus, there were no vegetables served (Padget & Briley, 2005).

A study conducted in Nova Scotia queried, with questionnaires, 101 licensed CCs about their meal planning (Romaine et al., 2007). Of those queried, only 35 centres replied. The authors found that only half of the menu planners had the relevant training and knowledge to develop menus as the majority of them (28) were deficient in either providing too much of a macronutrient or too little. The authors concluded that menu planners required additional training so that they could construct menus which met the growth requirements of children without causing obesity or other nutrient deficiencies.

The majority of the studies that have looked at meals provided to 3-5 yo children have measured the bulk macronutrient intake and the portion of the main food groups that were provided to the children. As an example, a study was conducted in North Carolina in 2005-2006 and the results of which were published in 2013. The authors undertook two days of observational data of food consumption by 120 children in 20 CCs (Erinosho, Ball, Hanson, Vaughn, & Ward, 2013). The authors reported that the majority of the meals provided by the centres met the requirements for dairy, fruit and sodium. However, the meals were significantly inadequate in providing a sufficient amount of vegetables, whole grain, oils and meat. Furthermore, the meals provided were in excess of the requirements for saturated fat and calories, suggesting that the meals provided were promoting excess weight gain. As with other studies, the authors did not measure the amount of food that was actually consumed by the children but rather the amount which was served. This is a significant drawback of the study as children waste a considerable amount of food, with one report indicating that 3-5 yo children only consumed 39 to 57% of what was served to them (Nicklas et al., 2013). Another limitation of the previous study is that observations only occurred over two days.

One of the very few studies which researched the intake of both macro- and micronutrients, similar to that proposed here, took place in Oklahoma and assessed the energy, macronutrients (carbohydrate, protein and total fat) and micronutrients (Ca, Fe, Mg, Zn, vitamins A and E and folate) consumed during lunch by 415, 3-5 years old pre-school children in 25 CCs (Rasbold et al., 2016). The authors of this study used a cross-sectional, observational study where they queried the cooks as to the composition of the recipes, such as the sugars, fats, oils, salt and such was used in the meal preparation. Additionally, they asked the types of meats (fat to meat content), the types of vegetables (fresh, frozen or canned), and the brand name of the items used. This data was then inputted into a nutrient analysis software to obtain the nutrient content of the meals. As can be expected, there was a significant difference between what was provided and what the children consumed. In term of the macronutrients: the children were served an average of 1782 kJ, 22.0 g protein, 51.5 g carbohydrate and 30.7 % of DRI total fat; the children consumed 1305 kJ, 16.0 g protein, 37.6 g carbohydrate and 28.9 % total fat. Based on the DRI, the served portion exceeded the requirements for energy, protein and carbohydrates while the consumption exceeded for energy and protein, but the carbohydrate intake was inadequate. The authors also noted that the amount of protein served was 3.5 to 5 times the recommended DRI. In terms of micronutrients, the served meal was comprised of 65.9 mg of Mg, 3.8 mg Zn, 250 µg vitamin A, 71.9 µg folate, and 1.4 mg vitamin E, the latter of which was inadequate according to DRI. As well, the served 2.8 mg of Fe was adequate as per the DRI for 1-3 yo children but inadequate for the recommended DRI for 4-8 yo children. Similarly, the consumed Ca (259.4 mg) and Zn (2.3 mg) exceeded the DRI for 1-3 yo children, but were insufficient as per the DRI for 4-8 yo children. The amount of consumed folate (48.3 µg) met the DRI guidelines while consumption was insufficient for Fe (1.9 mg) and vitamin E (1.0 mg).

Lastly, both Mg (47.2 mg) and vitamin A (155.0 µg) exceeded the DRI guidelines for a meal. One major drawback of this study is that the authors did not weigh the food served, nor did they analyze the actual amounts the children ate. This means that the authors have no way of drawing significant conclusions as to the amount of energy and nutrients the children actually consumed and whether they met, exceeded, or were deficient in meeting the DRI.

2.6 Intervention Food Adoption After the Intervention

Very little research has been conducted on the factors related to the adoption and continuation of nutrition education resources and interventions (McCullum-Gomez, Barroso, Hoelscher, Ward, & Kelder, 2006; Nanney, Johnson, Elliott, & Haire-Joshu, 2007). Given the importance of following provincial/state and federal guidelines when it comes to providing adequate and quality foods to children, and the large discrepancies between CCs in meeting those requirements, it is essential to understand why some nutrition education curricula are adopted, implemented and continued while others are not. To have an impact on public health, nutrition interventions must at first be effectively introduced into practice. Following the intervention, there must be changes in the behaviour of professionals at the CCs in order to ensure that the guidelines and interventions are sustained. At the beginning, professionals as well as institutions need to make the decision to work with the intervention (i.e. adoption), deliver the intervention as it is intended (implementation), and continue to use it over a long period of time (i.e. continuation) (Durlak & DuPre, 2008; Glasgow, Lichtenstein, & Marcus, 2003). Whether an intervention is sustained is dependent on a number of factors such as adopting persons, social setting, organizational context and culture, and innovation methods and strategies (Greenhalgh, Robert, Macfarlane, Bate, & Kyriakidou, 2004; Grol, 2013).

2.7 Diffusion of Innovations

The concept of Diffusion of Innovations (DOI), developed by E.M. Rogers in 1962, is one of the oldest social science theories. It originated in communication to explain how, over time, an idea or product gains momentum and diffuses (or spreads) through a specific population or social system. The end result of this diffusion is that people, as part of a social system, adopt a new idea, behavior, or product (Boston University School of Public Health, 2018). DOI theory suggests that perceived attributes of an innovation (new practice) strongly affect the adoption and diffusion of that practice (Rogers, 2003). According to Rogers (2003), there are five perceived attributes: relative advantage - degree to which an innovation is perceived as better than the practice it superseded; compatibility - degree to which an innovation is perceived as being consistent with existing values, past experiences, and needs of potential adopters; complexity - degree to which an innovation is perceived as difficult to understand and use; trialability - degree to which an innovation may be experimented with on a limited basis; observability - degree to which results of an innovation are visible to others (Rogers, 2003). The DOI attributes offer an important way to analyze the factors which influenced the adoption, implementation, and continuation of the PDTK pulse-based foods and practices in the participating CCs in Saskatoon.

2.8 Overweight and Obesity in Childhood

The present global rates of obesity cover the spectrum of people regardless of age, race, gender or geographical region (World Health Organization, 2015). The World Health Organization (2015) (WHO) estimated that there were 42 million children below the age of five in 2014, who were overweight or obese. A significant amount of research has indicated that a

proper diet during the years from birth to five years of age lays the foundation for children's dietary behavior and activities in later life (Needham et al., 2007; D. S. Ward, 2010). During these years, a proper quantity and quality of nutrients are required for children's optimal physical and cognitive development (Goldsborough et al., 2016; Scaglioni et al., 2011). However, these needs are not being fully met because increasingly children are consuming processed foods and at the same time adopting sedentary behavior (Pabayo et al., 2012; D. S. Ward, 2010). This factor is linked to a significant number of Canadian pre-school children becoming overweight or obese (Kakinami, Barnett, Séguin, & Paradis, 2015). Childhood obesity is not benign but has a marked effect on the behavior and health of these overweight and obese children once they become adults. One of the most comprehensive longitudinal studies conducted on obesity found that children who are overweight or obese during their early years are four times more likely to be overweight or obese during adulthood (Freedman et al., 2005). Moreover, obesity in early life has been linked to the onset of diseases, such as cardiovascular disease (CVD), in later life (Bazzano et al., 2016; Zhang et al., 2015). Given these facts, it is essential that children be provided a proper diet with adequate physical activities so that they develop into healthy adults who face a minimum of disease risks.

2.9 Plate Waste

Many of the behaviors children learn, such as food preference and consumption and physical activity, are often influenced by their parents or familial practices (Vedanthan et al., 2016). These behaviors favoring one food type over another, or preferring to play video games rather than playing outside, are activities which influence the development of children and also have consequences to their later adult health. Moreover, within a CC where there are other

children, the latter mimic or alter their behavior based on those of other children. In a recent longitudinal study, the authors observed the changes in behaviors of 238 three to five year old children in 23 daycare centres (Stéphanie Ward et al., 2017). To measure the changes in the children's behavior, over nine months, the authors measured their physical activity levels and plate waste at the beginning of the study and compared it to their behaviors at the end. The authors found that those children who were more sedentary at the beginning, became more active as they associated with the other children. Similarly, the amount of food wasted decreased over the nine months (Stéphanie Ward et al., 2017). In a recent study, it was found that food presentation in terms of its visual appeal, smell, variety of colors and texture also results in differences in the amount of food eaten and the amount of wasted (Olsen, Ritz, Kramer, & Møller, 2012). In the study, vegetables were either given whole, sliced, or cut in decorative figures. It was found that the children preferred vegetables cut in figures over the other two types (Olsen et al., 2012). Therefore, the preferences of one food over another can be due to their family's eating habits, adopting the behaviors of their peers, or to the sensory appeal of the food.

2.10 Role of the Family, School and CC Staff in Influencing Dietary Behavior in Children

The influences on children's dietary preferences are shaped by family, school and CC staff, and any other caregivers (Johnson, 2016). Children generally enjoy energy-dense foods that are sweet and salty with vegetables being the least liked because the latter often have a bitter taste to them (Vandeweghe et al., 2016). Children, especially infants and those who are pre-school, often reject familiar foods because of fussy or picky eating and also may become neophobic and reject novel or unknown foods (Johnson, 2016). However, much of the early eating behavior of children is learned and is shaped in infancy due to the caregivers making

available certain foods and other foods not. Vegetables, for example, are consumed the most in infancy and then its consumption decreases after the age of five (Johnson, 2016). However, these preferences can be changed if the caregivers provide constant and early exposure to foods that the children may initially not like. In a 2010 study conducted in the United Kingdom, the authors examined the relationship between fruit and vegetable consumption in seven yo children (n=7821) and the frequency and timing of introduction of fruit and vegetables found that children who were not presented home- made vegetable foods by six months of age ate fewer vegetables when they were 7 yo. However, children who were provided more vegetable at a later age ate the same amount of vegetables as the infants who were introduced to vegetable by six months. Moreover, the parenting style also influences children's eating behavior. Studies have shown that an authoritarian style where responses to children is low but high demands are placed on children to eat certain foods leads to children becoming more obese and to a greater rejection of foods; whereas an authoritative style where demands are still high but the caregivers are highly responsive to the children's eating cues promotes healthier eating behaviors (Birch, Savage, & Ventura, 2007). Furthermore, children who are offered a greater variety of foods when they are young, continue to consume a larger variety of foods in later life (Mennella, Nicklaus, Jagolino, & Yourshaw, 2008). Overall, then, children's eating behaviors and preferences are shaped in early life and often depend, amongst a host of other variables such as taste, texture, smell, color, on what foods and the variety are introduced to them in early life, to quality of caregiver attitudes, and the frequency of foods provided to them even to foods they may earlier have disliked. Food preferences, therefore, evolve and to a large extent are modifiable.

2.11 Demographics

Statistics Canada does not specify the population of 3-5 yo children there are in Canada but rather separates them into other age groups (Statistics Canada, 2016). However, the 3-5 yo age group comprises 3% of the Canadian population or approximately one million children. As noted previously, the majority of these children (54%) are sent to childcare with the children spending a minimum of 30 hours there (Sinha, 2014). The physical activity the children engage at CCs is quite varied, but in Canada, only 50% of CCs utilize outdoor physical activities as a part of their daily routines (Tandon, Zhou, & Christakis, 2012; Temple, Naylor, Rhodes, & Higgins, 2009). Furthermore, 45% of preschoolers (2.5 to 5 years old), do not engage in the recommended amount of physical activities (Tucker, van Zandvoort, Burke, & Irwin, 2011). This means that physical activity as engaged at both home and at the CCs is insufficient. What in the past was taken as granted, such as walking to school, is no longer the case as in the United Kingdom, i.e., 86% of the children do not walk to school, further limiting the amount of physical activity the children engage in (Brussoni et al., 2015). Exacerbating the situation is that children between the ages of 5-17 are spending 8 hours and 27 minutes of their waking time in sedentary (sitting or lying down) behaviour (Statistics Canada, 2017a).

As noted above, the sedentary behaviour and lack of physical activity has resulted in, historically speaking, very high levels of obesity. In Canada, over the last few decades, there has been an increasing trend of childhood obesity with present data indicating that approximately 20% of children between the ages of 5-12 are overweight while 12% are obese (Canadian Task Force on Preventive Health et al., 2015). A recent Canadian study sampled 19,026 2-5 years old Canadian children and found that 29.8% were overweight or obese, similar to the previous study (Kakinami et al., 2015). Statistics Canada recently released 2015 data on the BMI levels of 2-5

year olds using the WHO BMI classification and noted that 34.1% and 31.6% of Canadian and Saskatchewan children, respectively, were overweight or obese (Statistics Canada, 2017b). Since children learn much of their dietary behaviours from their parents and/or from CCs (Vedanthan et al., 2016), it is not surprising the high percentage of 3-5 year olds who are overweight or obese since the children are consuming the same foods that their parents consume. This is why it is illustrative to note that according to the Canadian Health Measures Survey, between 2009 and 2011, 67% of Canadian men and 54% of Canadian women aged 18 to 79 years were overweight (BMI 25-29.9) or obese (BMI $\geq$ 30.0) (Statistics Canada, 2012). In fact, approximately 6.3 million people, or one-quarter of the adult Canadian population, were considered to be obese (Navaneelan & Janz, 2014).

CHAPTER 3: METHODOLOGY

The present study builds on the work completed in Phase III of the PDTK- nutrition education intervention conducted at four CCs in Saskatoon. This section of the proposal describes the methodological approach that was being used to address the research objectives of this study. Prior to that, the study's author describes her roles during the PDTK intervention, a brief review of the recipe selection process, and the criteria of recipe selection that were used in order to choose the meals that were incorporated during the PDTK intervention.

3.1 My Role in the PDTK Intervention

I was hired as a research assistant in Phase III of the PDTK nutrition education intervention, which started in October 2016. In that role, I helped to deliver lessons about the nutrient qualities and benefits of pulses to children in two of the four CCs that participated in the intervention. I participated in the data collection in two of the CCs, both of which are close to the university and this made it convenient for me to get to them by bus and foot within a short period following my classes. I gave 12 lessons to the children regarding healthy eating, the different types of pulses and their nutritional and health benefits (Appendix C). In addition, I helped to grade the pulse intervention foods consumed by the children on a scale of not tasty, okay, and very yummy. Furthermore, I taught the children to be able to identify pulses in their diet. Lastly, the children and I germinated peas so that the children could learn where peas and pulses come from and how they are grown in Saskatchewan. Phase III of the study ended in April 2017.

3.2 Study Population & Target Centres

The study population was comprised of eight childcare staff, and children aged 3 to 5, who attended full time childcare five days a week. Criteria for selecting the study sites and the children were centres willing to participate with the study and parents who gave their consent for their children to participate, respectively. Children had to be between the ages of 3 to 5 in order to be included in the study. All eight cooks and directors in charge at the four CCs within Saskatoon were involved in the qualitative portion of the current study.

3.3 The Recipe Selection Process – A Review

The foodservice component of the PDTK nutrition education intervention was comprised of the integration of the following pulse-based foods: chickpea spread, three bean quesadillas, lentil pizza, and chicken chickpea stir fry. These foods provided to the children replaced the meals provided to the children before the intervention (Appendix B). In other words, these four pulse-based intervention foods replaced thirteen pre-intervention regular meals (Table 3.1). As an example, prior to the intervention, one of the food items was a pizza breakfast and this was changed to a lentil pizza during the intervention period. Altogether, four food items were changed during the intervention period by substituting pulses into the recipes. The PDTK foodservice menus were changed weekly over the course of the seven-month intervention.

The intervention recipes were selected from a variety of recipe books and web searches. The criteria for recipe selection were based on the Saskatchewan Ministry of Education Child Care Regulations and Eating Well with Canada's Food Guide. The selection also was based on the similarity to the regular menu item, the likelihood of adaptability, availability of ingredients, absence of food allergens, limited risk of choking, ease of preparation, and cost. Table 3.1 below

provides a detailed description of the pulse intervention meals and the regular foods they replaced.

Table 3.1: Pulse Intervention meals and the regular pre-intervention meals they replaced.

Intervention meals	**Regular meals**
Chickpea Spread	Cream Cheese Ranch Dip Veggie Dip Cheddar Cheese
Chicken Chickpea Stir-Fry	Chicken Parmesan Chicken Stir-Fry Chicken Stew
Three Bean Quesadillas	Chicken Wrap Beef Tacos Chicken Quesadillas Beef Quesadillas
Lentil Pizza	Pizza Breakfast Pizza

3.4 Research Design

The current study was of a multi-methods design that utilized both a quantitative and a qualitative component. The two methods were used to address the objectives of the study (Table 3.2).

Table 3.2: Summary of the methodological approach.

Objectives	Type of data	Tools	Variables	Statistical analysis
Objective 1: to determine and compare the intervention meals vs the regular selected meals in terms of macro- and micronutrients profile served to 3-5-year-old children at childcare centres.	Secondary data	Menu cycle of the selected meals served: (pulse-base food vs. regular meals) Note that the results for the macro- and micronutrients profile have been calculated for the selected recipes not for the whole meals and for 100g of each type of food using the Food Processor nutrition analysis software.	Macro and micronutrients: calories, proteins, carbohydrates, fats, saturated fats, total fibre, folate, calcium, iron, magnesium, potassium, sodium, zinc and the vitamins C and A	Descriptive statistics: -Mean -Standard deviation
Objective 2: to determine and compare the total grams of leftover food (plate waste) in both pre and post-intervention meals at childcare centres.	Secondary data	Digital photography enhanced Plate waste	The amount of food given & food eaten derived by subtracting the leftover from the total grams served in both pre-intervention meals and during-intervention meals.	Inferential statistics: -One-way ANOVA -Post-hoc test: Dunnett's test
Objective 3: to explore factors that influence adoption, implementation and continuation of a pulse-based nutrition education intervention (PDTK) in the meals served in childcare centres in Saskatoon.	Primary data	Semi-structured interviews	All interviews were conducted face to face by the researcher and lasted approximately 30 minutes. The interviews were analysed according to themes which emerged in the interviews e.g. - amount of time it took to cook the recipes -difficulty in preparation of the recipes -cost of the pulses	constant comparative method

Firstly, the nutrient profile of both regular and intervention meals, previously collected during Phase III of the project PDTK- nutrition education intervention using direct observation (see below for the general design of the PDTK nutrition education intervention), was analysed to compare the macro- and micronutrients profile (e.g. regular pizza compared to replacement lentil pizza). Secondly, since the plate wastage data of the pulse and replaced foods were known, the food waste data were also analysed to see what percent of food, in both pre and during the interventions, was wasted. This is likely to provide general data on food waste, but specifically provide data on whether pulse-based foods were preferred or not. Data for these quantitative analyses were obtained from the Phase III-PDTK nutrition education intervention study.

Lastly, the qualitative part of this study consisted of interviewing eight childcare staff (four cooks and four directors) in charge of the four CCs to determine if they continued to use pulse foods in their menus and the factors that influenced their practice. I explored participants' experiences with using pules recipes a year after cessation of the intervention to determine if they continued to use pulse foods in their menus and the reasons for continuing or not continuing the practice. The qualitative portion of this study, which was done one year after the intervention, allows the researcher to explore phenomena, such as feelings or thought processes, that are difficult to extract or learn about through conventional research methods (Strauss & Corbin, 1998). Moreover, qualitative research methods are the best approach when studying phenomena in their natural settings (Denzin & Lincoln, 2000), and when striving to understand social processes in context (Esterberg, 2002). The current study focused on directors and cooks' experience with the pulse-based recipes provided. Furthermore, qualitative methods emphasize the researcher's role as an active participant in the study (Creswell, 2016). For the present study, I, the researcher, was the key instrument in data collection, and the interpreter of data findings.

Qualitative research methods used in this study included: purposive sampling, semi structured interviews, and systematic and concurrent data collection and data analysis procedures. Specifically, the constant comparative method (Glaser & Strauss, 1967) was used to analyze the data and discover the CC's staffs' perceptions and experiences with incorporating pulses-based recipes into the regular menus. However, even though the constant comparative method follows the basic principles of grounded theory (Glaser & Strauss, 1967), it differs from the latter in a number of important ways. Significantly, the constant comparative method "generates and tests theory provisionally, focuses on causation and requires that all data be tested against the hypothesis, while grounded theory focuses generation and constant comparison" (Anderson & Jack, 2015, p. 16)

3.5 Data Collection and Data Analysis

3.5.1 Quantitative Data-Nutrient Profiles and Plate Waste

Data for this portion of the project were obtained from Phase III of the PDTK nutrition intervention study. Trained graduate nutrition students and research technicians from the University of Saskatchewan collected the data. The intervention consisted of replacing thirteen regular meals with pulse-based food items. The pre-and during-intervention menus and the specific recipes for each individual food item were collected weekly over the duration of the study.

To determine and compare the intervention meals vs the regular selected meals in terms of macro- and micronutrient profile, the recipes from each CC were entered into the Food Processor Nutrition Analysis Software by trained and experienced research assistants. The nutrient amounts in the foods were assessed using the Food Processor nutrition analysis software

(Food Processor, ESHA version 10.10.00). Although the software provided the amount of all macro- and micronutrients for every food type that was provided to the children, only the following were considered: calories, proteins, carbohydrates, fats, saturated fats, total fibre, calcium, folate, iron, magnesium, potassium, sodium, zinc and the vitamins C and A (Appendix D). Food Processor then provided outputs of the amounts of macro and micronutrients each child consumed. Comparisons were made between the pre and during-intervention menus.

To determine and compare the total grams of leftover food (plate waste) in both pre and post-intervention meals, food consumption data of the target regular and pulse-based meals were collected, using uniform protocols throughout the intervention. Student data collectors weighed and photographed the meals sent to the children, weighed any additional servings, and then weighed the leftovers, using a digital scale (Salter Magic Display Electronic Scale 10B55BKEF: Springfield instruments), once the children were finished their meals. The method utilized in the present study was previously validated by a previous study (Bélanger et al., 2016). Food eaten was calculated, using the plate waste Android app installed on tablets "ASUS Memo Pad HD7," as what was given minus the amount leftover. The percent of food wasted by each child was calculated simply as the ratio of the amount of the food not eaten against what was served, multiplied by 100. The average plate waste for all four CCs were combined, and the percent plate waste for each food item was calculated. This allowed us to better understand whether too much food is being served and the food preferences of the children. It should be noted that data for children who refused the meals were excluded from the analysis.

Quantitative data were analysed using the Statistical Package for Social Science (SPSS) version 20. Descriptive statistics such as mean and standard deviation for each macro- and micronutrient profile, and plate waste, were calculated. One-way analysis of variance (ANOVA)

was run to determine significant differences for the plate waste data. Then, a post-hoc Dunnett's test was run to determine which regular meals differed from the pulse foods in terms of food wasted (Hae-Young, 2015). The four categories of foods were tested individually within the group. For example, lentil pizza was calculated against the regular pizzas. A confidence level of $\alpha = 0.5$, or 95% confidence interval, was deemed significant.

3.5.2 Qualitative Semi-Structured Interviews

Qualitative data explored factors that influence adoption, implementation and the continuation of the PDTK nutrition education intervention in four CCs in Saskatoon using semi-structured interviews (Appendix E). The interview guide questions were based on the study's objective and guided by a review of the pertinent literature (Sharma, Hedberg, Skala, Chuang, & Lewis, 2015). In other words, the questions were framed so that the questions asked in the present research could be satisfactorily answered. Furthermore, the research question was composed with the help of the author's supervisor and one committee member. The semi-structured interview allowed the interviewer to stray from the interview guide and ask follow-up questions as the interviewer believes appropriate. This provided a way to gain additional information by allowing respondents to express their views in their own words.

3.5.2.1 The Interview Process

The school staff consisting of four directors and four cooks who participated in the PDTK intervention were queried a year after cessation of the intervention to determine if they continued to use pulse foods in their menus and the reasons for continuing or not continuing the practice. The interview process consisted of the researcher (myself) contacting the cooks and the director to find a suitable time that they could meet. The interview took place at each of the four CCs. All

interviews were conducted face to face, and lasted approximately 30 minutes. Interviews were recorded using an audio recorder, with prior approval from the participants, while the field notes were immediately summarized. The audio recording was further transcribed by myself, the researcher, prior to analysis.

3.5.2.2 Qualitative Data Analysis

The interviews were analysed according to themes that emerged in the interviews (e.g. availability of pulses, cost barriers, time factors). The analysis initially followed an inductive approach, meaning that transcripts were read several times, first to become familiar with the data and then to code the data. The theoretical framework that defined the analysis consisted of using the constant comparison method, an approach often used in qualitative research more than with quantitative research (Memon, Umrani, & Pathan, 2017). In this approach, rather than filtering the data with a specific question, common words voiced by the interviewees are used as the basis for analysis. As an example, if in the present work, a common word or words used by more than half of the interviewees was it “takes too long to make the recipes”, or “the kids don’t like the food”, then the themes that emerge are length of time and distaste as two themes that emerge from the analysis. Therefore, common words, or common factors were analysed from all of the transcribed interviews. To ensure that they corresponded to the identified construct, the quotes within each theme were re-examined by another researcher.

3.5.2.3 Trustworthiness

Qualitative research entails the researcher takes an active role in the data collection process and interpretation of others’ meaning making. Therefore, to be credible, qualitative researchers must be trustworthy. Stake (1995) cautioned qualitative researchers against narrow

thinking, and instead suggested that researchers learn to understand their research as their participants do, rather than impose their own assumptions. In qualitative research, this protocol is described as “triangulation” (Stake, 1995, p.109) of the data. To increase the trustworthiness of the study’s findings, I employed several strategies recommended by renowned qualitative researchers. To decrease threats to credibility (Lincoln & Guba, 1985), qualitative data sources included in-depth interviews as well as findings from the literature to confirm emerging findings, (Merriam, 2002; Yin, 2009). In addition, member checks were performed (Merriam, 2002) by sending participants a copy of their interview transcript and asking them to verify the accuracy of the content. My supervisor and another member of the committee also reviewed findings from the transcripts (Merriam, 2002).

3.5.3. Ethical Consideration

Ethical approval was obtained from the Behavioral Research Ethics Board at the University of Saskatchewan. Further, a letter of consent approval was obtained from the directors and cooks from each site prior to primary data collection.

CHAPTER 4: RESULTS

The PDTK intervention, conducted in 2015-2017 with pre-school aged students, was undertaken at four CCs in Saskatoon. The aim of incorporating pulses in the children's food menu was to improve the children's dietary nutrition intake, to develop healthy eating behavior, and to add a nutrient source which is more affordable. Specifically, the objectives were: 1) to determine and compare the intervention lunch and snack meals vs the regular meals for their macro- and micronutrient profiles; 2) determine and compare the plate waste of the varying pre and post-intervention meals; and 3) to qualitatively, through semi-structured interviews, explore factors that influence adoption, implementation and continuation of pulse-based recipes in the meals served by the CCs staff in Saskatoon.

The following macro- and micronutrients were measured: calories, proteins, carbohydrates, fats, saturated fats, sodium, total fibre, calcium, folate, iron, magnesium, potassium, zinc and the vitamins A and C. Note that the results for the macro- and micronutrients have been calculated for 100g of each type of food.

4.1 The Nutrient Content of Intervention Pulse-based and Regular Foods

4.1.1 Energy

In general, the energy (kcal) in the pulse-based intervention foods were lower than the kcal in the foods that were replaced. The number of kcal in the chicken chickpea stir-fry (85.2 kcal) was lower than that of chicken stir-fry, chicken stew and chicken parmesan (Figure 4.1).

The kcal in the three bean quesadillas (224 kcal) was higher than that in the chicken wrap (175) but lower than the beef tacos (240 kcal), chicken quesadillas (294 kcal), and the beef quesadillas (281) (Figure 4.2).

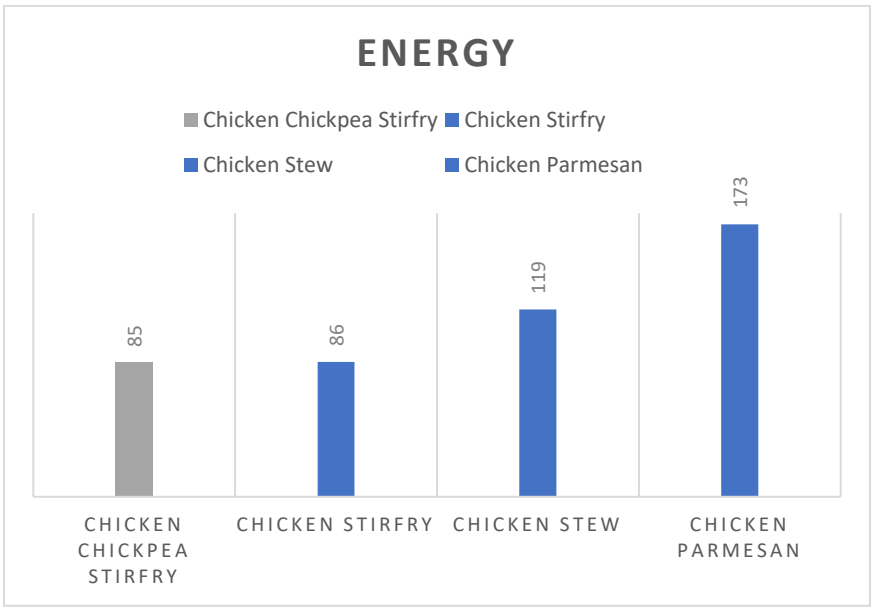


Figure 4.1: Comparison of energy, in kcal, in chicken chickpea stir-fry and the regular foods it replaced. Data derived from Food Processor nutrition analysis software.

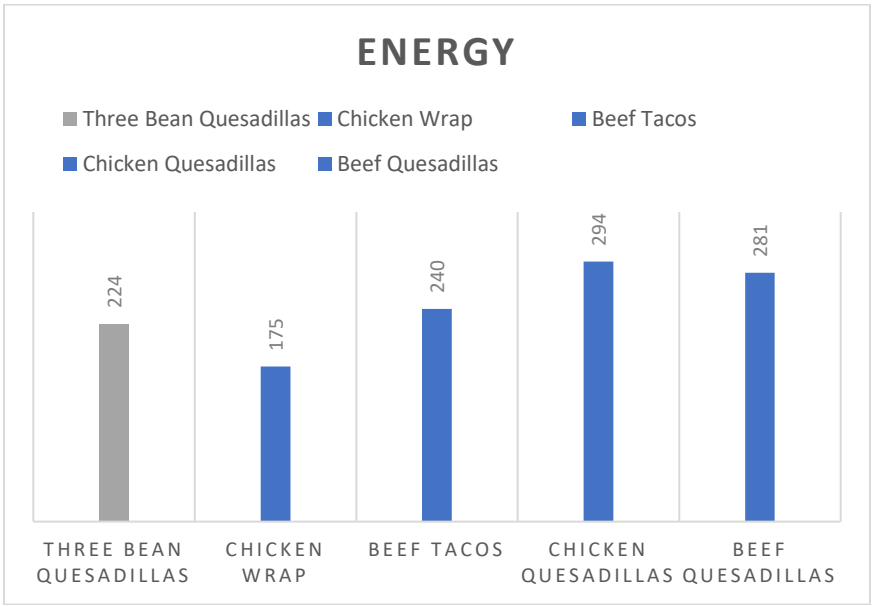


Figure 3.2: Comparison of energy from three bean quesadillas and the regular foods it replaced.

The calories in the chickpea spread was significantly lower (135 kcal) than in the ranch dip (398), veggie dip (484 kcal), cream cheese (350 kcal), and cheddar cheese (393 kcal) (Figure 4.3).

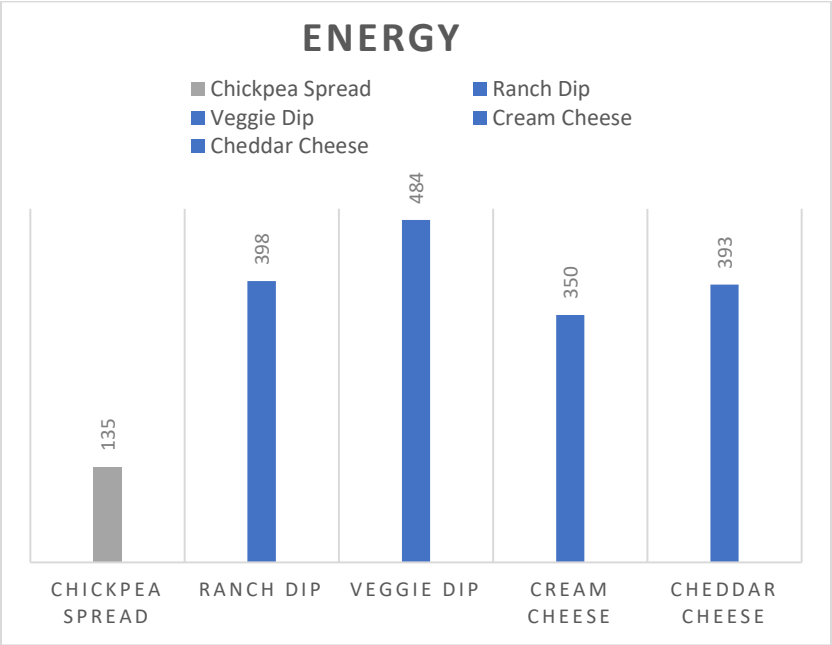


Figure 4.3: Comparison of energy from chickpea spread and the regular foods it replaced.

The calories in the lentil pizza was lower (142 kcal) than that found in both the pizza (213) and the breakfast pizza (204) (Figure 4.4).

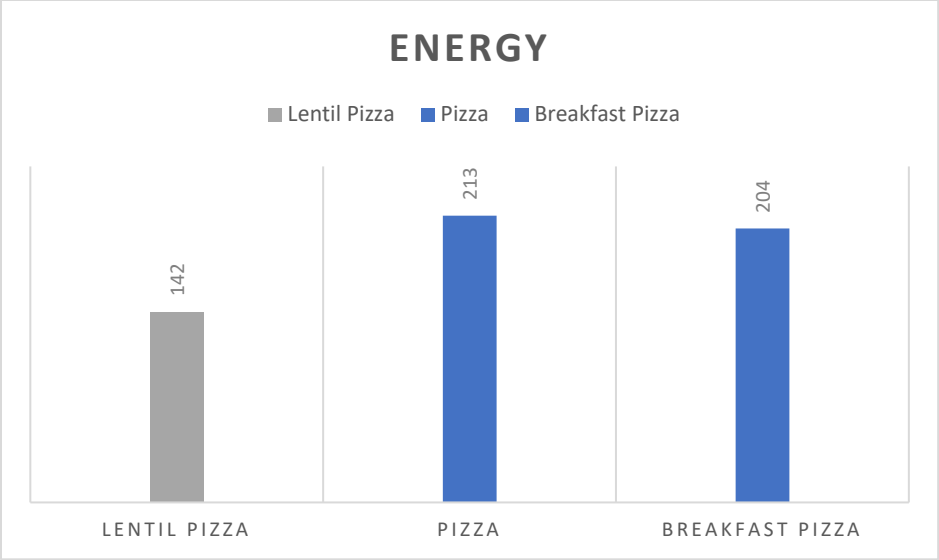


Figure 4.4: Comparison of energy from lentil pizza and the regular and breakfast pizza it replaced.

4.1.2 Protein

Protein levels in the various foods differed with the highest amounts, per 100g serving, in cheddar cheese (21.4 g) while the lowest was in the veggie dip (1.0 g) (Table 4.1). For the pulse intervention foods, the highest protein levels were in the chicken chickpea stir-fry (10.5 g) while the lowest was in the chickpea spread (6.2 g).

4.1.3 Carbohydrates

There were large differences in the amount of carbohydrates contained in the regular and the pulse-based foods (Table 4.1). In the regular foods, the cheddar cheese contained no carbohydrates while the chicken quesadillas contained 36.3 g. Amongst the intervention foods, the lowest carbohydrate levels were in the chicken chickpea stir-fry (6.9 g) while the highest amounts were in the three been quesadillas with 27.1 g.

4.1.4 Total Fibre

In general, the pulse-based intervention foods had greater amounts of fiber as compared to the regular foods (Table 4.1). The highest fiber amounts were in the chickpea spread (5.6 g) while the lowest were in the lentil pizza (2.5 g). In the regular foods, chicken quesadillas had the highest fibre content with 4.7 g while the ranch dip, and the cream cheddar cheeses contained no fibre.

4.1.5 Fats and Saturated Fats

The greatest amount of fat in the regular meals was found to be in the veggie dip (51.4 g) while the lowest amount was in the chicken stew (1.3 g) (Table 4.1). Comparatively, the pulse-based foods had significantly lower amounts of fat with the chicken chickpeas stir-fry containing only 1.8 g while the three bean quesadillas had 9 g.

With respect to the saturated fat, the pulse-based foods had lower amounts as compared to the regular foods. The lowest level of saturated fat in the pulse meals was found in the chicken chickpeas stir-fry (0.3 g) while the highest was in the three bean quesadillas (4.1 g) (Table 4.1).

4.1.6 Calcium

The levels of calcium contained in the meals was highly different. The pulse-based intervention meals differed from a high of 215 mg for the three bean quesadillas and a low of 44 mg in the chickpeas spread (Table 4.1). In the regular meals, the lowest levels of calcium were found in the chicken stew (10.4 mg) while the highest, as can be expected, were found in cheddar cheese which contained 714 mg.

Table 4.1: Macro and micro-nutrients in the pulse-based (green) and regular foods. Data derived from Food Processor nutrition analysis software.

Recipes	I* / R*	Energy (kcal)	Protein (g)	Carbohydrates (g)	Total Fibre (g)	Fat (g)	Saturated Fat (g)	Potassium (g)	Sodium (g)	Calcium (mg)	Iron (mg)	Magnesium (mg)	Zinc (mg)	Folate-DFE (µg)	Vitamin C (mg)	Vitamin A (IU)[a]
Chicken Chickpea Stir-Fry	I	85	10.5	6.9	1.96	1.83	0.27	0.24	0.14	30	0.7	19.5	0.49	33.8	43.2	1564
Chicken Stir-Fry	R	86	11.1	4.5	1.16	2.47	0.43	0.28	0.53	28	0.6	13.7	0.62	9.7	14.9	10
Chicken Stew	R	119	12.7	13.3	1.21	1.33	0.38	0.44	0.10	10	0.9	23.9	0.60	8.8	10.4	124
Chicken Parmesan	R	173	14.9	10.5	1.49	7.54	3.28	0.24	0.44	132	1.0	22.5	0.95	9.3	1.1	499
Three Bean Quesadillas	I	224	9.9	27.1	4.95	8.97	4.11	0.14	0.41	215	2.0	17.4	0.96	49.0	6.6	389
Chicken Wrap	R	175	7.4	17.9	2.80	8.55	2.15	0.15	0.33	76	1.4	9.0	0.20	57.7	1.8	3701
Beef Tacos	R	240	17.7	22.9	3.20	9.03	3.25	0.27	0.35	21	2.8	39.5	4.01	19.5	0.9	126
Chicken Quesadillas	R	294	12.8	36.3	4.74	11.43	4.54	0.01	0.60	197	2.2	4.8	0.65	4.8	2.1	221
Beef Quesadillas	R	281	18.3	21.9	2.84	13.43	5.30	0.17	0.34	130	2.5	13.0	3.24	7.0	0	142
Chickpea Spread	I	135	6.2	21.4	5.62	3.21	0.36	0.12	0.45	44	1.0	22.4	0.54	39.0	1.3	105
Ranch Dip	R	398	3.3	5.0	0	39.77	4.97	0	0.62	66	0	0	0	0	0	0
Veggie Dip	R	484	1.0	6.7	0.70	51.39	8.02	0.06	0.82	31	0.6	5.0	0.40	4.0	3.4	38
Cream Cheese	R	350	6.2	5.5	0	34.44	20.21	0.13	0.31	97	0.1	9.0	0.50	9.0	0	1111
Cheddar Cheese	R	393	21.4	0	0	35.71	21.43	0	0.61	714	0	0	0	0	0	1071
Lentil Pizza	I	142	8.7	13.8	2.54	5.83	3.33	0.24	0.24	144	1.0	11.3	0.59	7.6	17.2	259
Pizza	R	213	10.7	14.8	1.53	12.64	6.09	0.18	0.74	106	1.9	27.3	1.13	16.4	5.0	567
Breakfast Pizza	R	204	12.0	6.3	0.29	14.22	6.03	0.12	0.28	195	1.0	13.5	1.42	29.2	0.1	655

I*: intervention recipe. R*: regular recipe. [a] The vitamin A in IU units cannot be compared to the RDA

4.1.7 Iron

The concentrations of iron in the regular foods differed from a high of 2.8 mg in the beef tacos to a low of zero iron in the ranch dip and cheddar cheese (Table 4.1). In the intervention meals, the lowest iron level was in the chicken chickpeas stir-fry (0.7 mg) with the highest being 2 mg in the three bean quesadillas.

4.1.8 Magnesium

In the intervention meals, the highest magnesium level in the chickpea spread (22.4 mg) while there was only11.3 mg in the lentil pizza (Table 4.1). For the regular meals, magnesium levels ranged from a high of 39.5 mg in the beef tacos to a low of zero mg in the cheddar cheese.

4.1.9 Zinc

The lowest levels of zinc in the pulse-based meals were found in the chicken chickpeas stir-fry (0.5 mg) while the highest were in the three bean quesadillas (1 mg) (Table 4.1). In the regular meals, the ranch dip and cheddar cheese contained no zinc while the highest amounts were found to be in the beef tacos (4 mg).

4.1.10 Vitamin C

The levels of vitamin C in the pulse-based was significantly higher than that found in the regular non-pulse-based foods. Chicken chickpeas stir-fry had the highest vitamin C amount amongst the pulse foods with 43.2 mg while the lowest was in the chickpeas spread with 1.3 mg (Table 4.1). In the non-pulse foods, the beef quesadillas, ranch dip, cream cheese, and cheddar cheese had no vitamin C while the highest amount was in chicken stir-fry (14.9 mg).

4.1.11 Folate

In general, the pulse-based foods had higher quantities of folate as compared to the regular foods. The lowest folate levels in the intervention meals were contained in the lentil pizza (7.6 µg) while the highest was in the three bean quesadillas (49.1 µg) (Table 4.1 and Figures 4.5-4.8). On the other hand, in the regular foods, ranch dip and cheddar cheese contained no folate while the highest amount was present in the chicken wrap (57.7 µg). Amongst the pizzas, the lentil pizza had the lowest amount of folate (7.5 µg) while the breakfast pizza had the most (29.2 µg).

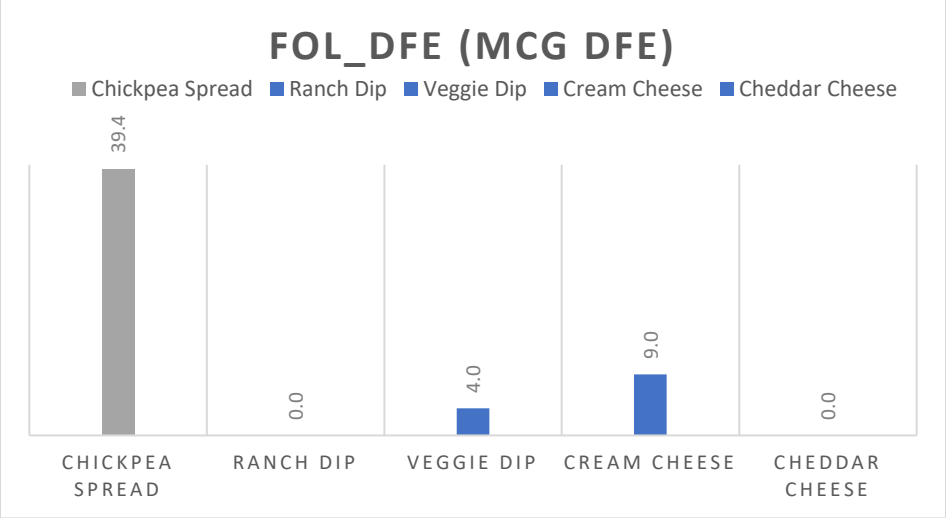


Figure 4.5: Dietary folate equivalent in pulse and non-pulse-based foods.

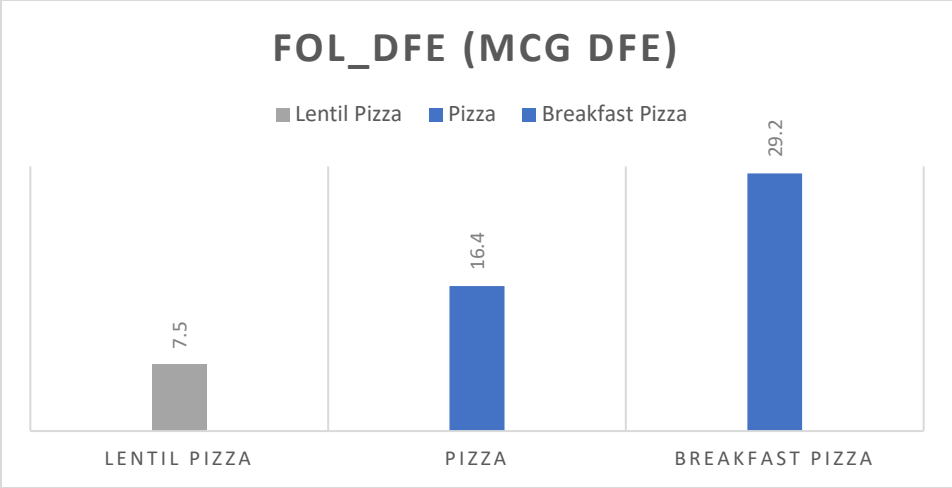


Figure 4.6: Dietary folate equivalent in different pizzas.

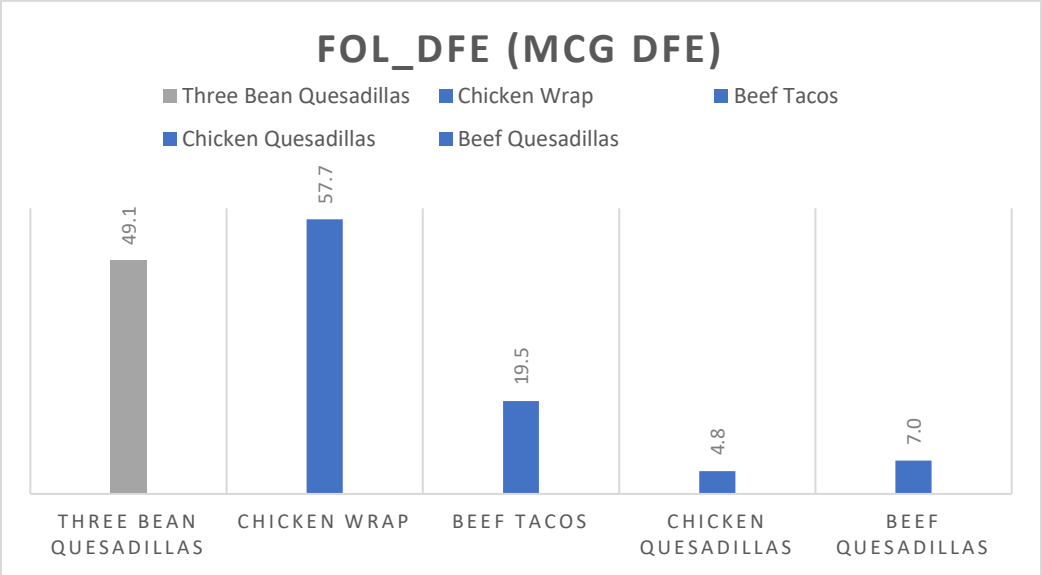


Figure 4.7: Dietary folate equivalent in pulse and non-pulse major meals.

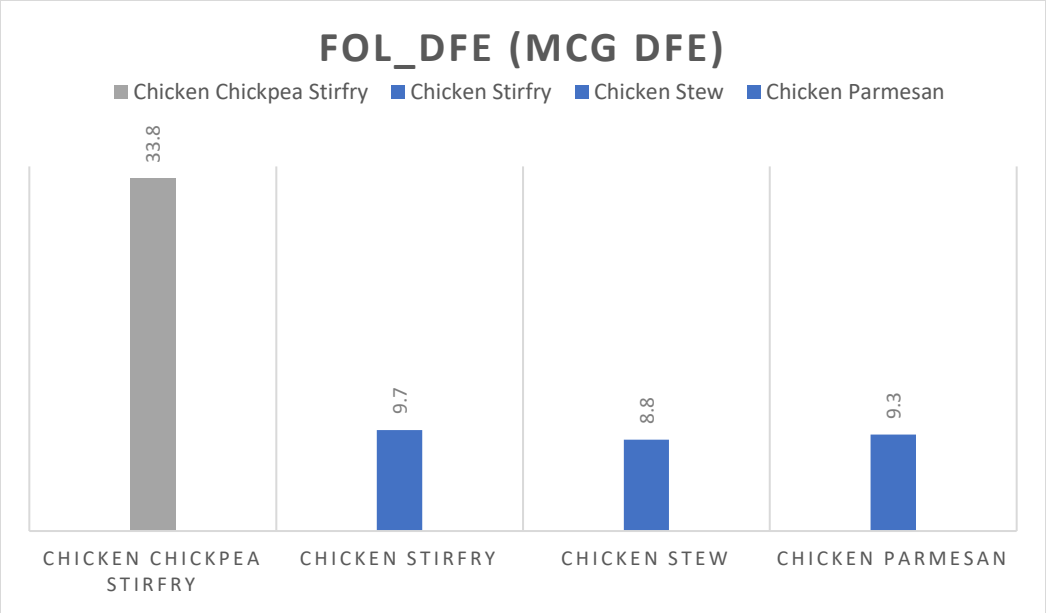


Figure 4.8: Dietary folate equivalent in pulse and non-pulse-based foods.

4.1.12 Vitamin A

Vitamin A levels in the intervention and non-intervention foods were quite different. In the non-pulse meals, the ranch dip contained no vitamin A while the highest amount was found in chicken wrap with 3701 IU (Table 4.1). Chicken chickpeas stir-fry had the highest amount of vitamin A (1564 IU) amongst the pulse foods while the lowest was chickpea spread with 105 IU.

4.2 Plate Waste

The plate waste data for all four CCs were combined, and their means and standard deviations determined (Table 4.2). The plate waste was highly variable for the regular and the pulse-based foods. However, generally, the food waste was greater for the pulse-based foods in each of the groups they replaced. Percent wise, 78% of the ranch dip went uneaten, which was the highest leftover of all of the intervention and non-intervention foods. Beef tacos was the least wasted food (5.4%) followed chicken quesadillas (9.5%). Amongst the pulse foods, the greatest wastage was for the chickpea spread (52.8%), followed by chicken chickpea stir-fry (47.7%), lentil pizza (38.2%) and the least wasted was the three-bean quesadilla (36.8%).

Using one-way ANOVA, significant differences in plate waste percent of the four groups of foods which were replaced with pulse-based foods were determined. It was found that there was a statistically significant difference in the plate waste of the foods ($p < 0.05$). Therefore, a post-hoc Dunnett's post-hoc comparison test was run to determine which of the regular meals significantly differed from the pulse meal. The Dunnett's test revealed that there was a significant difference in the plate-waste between chicken chickpea stir fry and both chicken parmesan ($p < 0.05$) and chicken stew ($p < 0.001$), but no difference from chicken stir fry. It was also found there was a significant difference between three bean quesadillas and beef tacos ($p < 0.001$) and chicken quesadillas ($p < 0.05$). There was a significant difference between the chickpea spread and cream cheese ($P < 0.001$) and cheddar cheese ($p < 0.001$).

Table 4.2: Mean food waste of the different regular and pulse-based meals.

Food	N	Mean Food Waste % (SD)
Chicken Chickpea Stir Fry	78	47.72 (± 35.3)
Chicken Parmesan	44	*31.47 (± 31.8)
Chicken Stir Fry	21	40.91 (± 36.1)
Chicken Stew	40	***21.33 (± 24.2)
Three Bean Quesadillas	95	36.79 (± 34.2)
Chicken Wrap	32	21.11 (± 27.4)
Beef Tacos	20	***5.47 (± 13.0)
Chicken Quesadillas	12	*9.51 (± 26.4)
Beef Quesadillas	30	33.76 (± 37.7)
Chickpea Spread	64	52.82 (± 40.4)
Cream Cheese	13	***10.77 (± 29.0)
Cheddar Cheese	15	***13.33 (± 35.2)
Ranch Dip	7	78.29 (± 35.6)
Veggie Dip	15	47.71 (± 30.2)
Lentil Pizza	85	38.20 (± 30.0)
Pizza	61	29.76 (± 33.5)
Breakfast Pizza	42	31.98 (± 33.3)

**p <0.05, **p <0.01, ***p <0.001: significantly different from the pulse intervention, determined by one-way ANOVA followed by Dunnett's post-hoc comparison.*

4.3 Results from Qualitative Data

Using the constant comparison method (Memon et al., 2017) to analyse the interview data, five key themes emerged as to the barriers in continuing to use the PDTK recipes: awareness of the CC food guidelines; amount of time it took to cook the recipes; difficulty in preparation of the recipes; cost of the pulses; fatiguing the children with too many pulses in their foods; and having difficulty in having the kids eat the PDTK recipes (Table 4.3).

4.3.1 Awareness of the CC Food Guidelines

All of the people interviewed about the CFG and SCNG, all except one was aware of them. A typical answer provided by all of the cooks and directors was that “Our menu follows the CFG. We have to follow it by regulation”. Only one of the cooks seemed unaware about the rationale for following either the CFG or the SCNG guidelines as she stated that she follows “just what was given to me by Saskatchewan Learning”.

4.3.2 Time as Barrier to Cooking PDTK Recipes

The second identified barrier was the amount of time it took to cook the recipes. Two of the four directors thought time was a factor with one noting that “I think the dips were little time consuming if you are getting everything else ready and then you have to make the dips. Sometimes the soaking of things [pulses]”. There were two directors who did not think cooking time was a factor. However, the same director thought contamination of the lentils and having one of the children be allergic to them was. He noted that some of the children at the CC “do have allergies, so some of the pulses we find that we can’t guarantee to be allergic or contaminated”.

Of the cooks, three did find time to be a factor. A typical response was that it took a long time to prepare the recipes, and that they were not simple to make. A typical response from one of these cooks was that “they take a lot of time cooking because they need an extra liquid [lentils placed in water overnight], and because you have large quantities it takes even that much more time. So many times I would have to cook it a day ahead to get that part started and prepared to get ready for the next day”.

4.3.3 Difficulty in Recipe Preparation

The theme of the difficulty in preparing the recipes was a factor for all of the cooks but only one director thought this was an issue. Three of the directors did not think preparation was an issue. One of the directors who did not think time was a factor stated that "from the recipes that you gave us, I think we did a couple of times right after [the intervention]. And we kind of stepped back and took a break just because we found that when we did those recipes, especially the ones we did, and they became quite repetitive for the kids." The directors who agreed seemed to be aware of the time factor, which was an issue for all of the cooks. One of the cooks stated that "we tried everything you wanted us to do in the test run. But it wasn't a lot of success. And then there is a lot, a lot, a lot of work. And then nobody is eating it."

4.3.4 Cost of the Pulses

In terms of costs, three of the directors and none of the cooks thought that cost was a barrier. One of the directors noted that "cost can definitely be a challenge. And availability. It is getting better for pulses as they are more readily available. But both were an issue at one point. But it is getting more easier to find." Of the cooks, all simply said "no" when queried about cost being a challenge.

4.3.5 Pulse Fatigue

All of the directors and all of the cooks noted that fatiguing the children with too many pulses in their foods was an issue as to why they had stopped using the recipes. A typical response was simply that they could not be "repetitive" as this led to food being leftover. One response was that "if there is food leftover then usually you know they didn't enjoy it." While

another stated that “I mean if there is food leftover, then usually you know if there is a lot of food leftover that means that they did not enjoy it, or maybe need a few more times to try it. Also, the educators will report back to the cooks that and say that all the kids love it today or only five of the kids tried it.”

4.3.6 Difficulty in Having Children Eat the PDTK Recipes

The last identified theme was that of having difficulty in having the kids eat the PDTK recipes. All of the cooks and the directors noted that besides preparation time and other difficulties, they found it difficult to have the children accept the PDTK recipes. Several of the interviewees noted that the only exception was the lentil pizza, although it was the third most wasted food. One comment from a director was that the children were unfamiliar with pulse-based foods and said “I think a lot of them are not familiar with pulses. They are not sure what they are. But you know, it is all a learning experience for them. Just encouraging them to try so they can become familiar with it. It is mostly that they have not been exposed to it before.” While a cook noted that the PDTK recipes were not a success because the kids were “not fans. I think it is a texture thing. And if they are not used to eating it at home, like you will see different cultures that are used to eating it. You can tell when they are used to eating pulse-based proteins when they come in because they will chow everything down. But some of them definitely don’t get introduced to it at home.”

Table 4.3: Interview responses of directors and cooks from four childcare centres.

	Day Care Food Guide Awareness	**Pulse Use Prior to Intervention**	**Intervention Foods After PDTK**	**PDTK Foods After One Year**	**Themes**				
					Barriers to Pulse Foods (Cost)	**Barriers to Pulse Foods (Time)**	**PDTK Preparations Difficulty**	**Pulse Fatigue-kids**	**Pulse Acceptance by Children**
Director A	Yes	4/month	Once or Twice	Once month	Yes	No	No	Yes	Difficult
Director B	Yes	4/month	Once or Twice	Once month	No	Yes	No	Yes	Difficult
Director C	Yes	4/month	Once or Twice	Once month	Yes	No	Yes	Yes	Difficult
Director D	Yes	Did Not Know	Once or Twice	Did not know	Yes	Yes	No	Yes	Difficult
Cook A	No	4/month	Once or Twice	No	No	No	Yes	Yes	Difficult
Cook B	Yes	6-7/month	Once or Twice	No	No	Yes	Yes	Yes	Difficult
Cook C	Yes	6-7/month	No	No	No	Yes	Yes	Yes	Difficult
Cook D	Yes	6-7/month	Once or Twice	No	No	Yes	Yes	Yes	Difficult

CHAPTER 5: DISCUSSION

This section discusses the findings of the present study, followed by a discussion of the main strengths and limitations of the thesis as a whole, and ends with recommendations for future research. To reiterate, the objectives of the present study were: 1) to determine and compare the intervention lunch and snack meals vs the regular meals in terms of macro- and micronutrient profiles served to 3-5-year-old children at CCs; 2) to determine and compare the total grams of leftover food (plate waste) in both pre and post-intervention meals; and 3), to explore factors that influence adoption, implementation and continuation of a pulse-based nutrition education intervention in the meals served in CCs in Saskatoon.

5.1 Micro and Macronutrient Profiles of Pre and Post Intervention Recipes

Generally, the calories in the pulse-based recipes were lower than those of the regularly served recipes. However, the regular meals served to the children in the CCs studied were generally wholesome. In contrast, a US study of CC found that meals are often high in caloric content and sugars (Benjamin Neelon, Vaughn, Ball, McWilliams, & Ward, 2012). Although the pre-intervention meals served to children at the CCs were wholesome, the low caloric intake of pulse-based foods speaks favorably of adopting pulses to the meals served in CCs.

In terms of protein, the pulse-based recipes provided, on average, less protein than the regular recipes (those containing meat dairy, etc.). This is not alltogether surprising as the pulses were matched against foods that contained meats and dairy products. Regardless, the protein provided by the pulses is plant-based, with the latter being highly recommended by Health Canada's recent food guidelines (Government of Canada, 2019). The DRI of protein

recommended by Health Canada, for children between the ages of four to eight, is 0.95 g/kg/day (Health Canada, 2006). Assuming an average weight of 20 kg for a child in the present study, this would translate to approximately 19 grams of protein a day. In this sense, the children at the Saskatoon CCs are receiving approximately half of their DRI in one serving of the regular and pulse-based foods at lunch. For beef quesadillas, however, with 18.3 g of protein and the cheddar cheese with 21.4 g of protein, it means that the children are meeting or even exceeding their protein DRI. Moreover, if the children are receiving other foods with average or high levels of protein at home or in other meals at the CCs, this means that they are easily exceeding the DRI. In a study of a CC in the US, it was found that the children were receiving, on average, 22 g of protein in just one meal (Rasbold et al., 2016). The researchers also noted that in some cases, the amount of protein served was 3.5 to 5 times the recommended DRI. Overconsumption of protein, especially one that is meat-derived, is not without adverse effects. The latter include bone and calcium homeostasis disorders, renal function disorders, increased risk of cancer, adverse liver function, and increased progression of coronary artery disease (Delimaris, 2013). A further benefit of pulses, or other plant-derived proteins, are that they are much less costly than meat-based proteins (Malav, Talukder, Gokulakrishnan, & Chand, 2015).

The carbohydrates provided to the children differed in both the pre and post-intervention foods. Although some of the foods, such as the cheddar cheese, contained no carbohydrates, the cheese was primarily a snack or addendum to a larger meal. Generally speaking, the carbohydrates provided by the pulses were similar to that of the regular foods. Both the cooks and CC directors indicated that the carbohydrates provided to the children seemed adequate. It has been found, however, that parents at times do provide inadequate amounts of carbohydrates and other nutrients in the lunch meals prepared for their children. For example, a study

conducted in Texas found that parent-prepared meals for their children were, 50 percent of the time, 33 percent inadequate in providing the DRI of carbohydrates (Sweitzer, Briley, & Robert-Gray, 2009). Another study conducted in 25 CCs where food was prepared and served to the children found that the CCs provided inadequate amounts of carbohydrates (Rasbold et al., 2016). Regardless, a notable feature of carbohydrates in pulses is that they do not contribute to postprandial glycemic and insulinemic responses, as is common in other foods that break down quickly once consumed (Tovar, 1996). In other words, the GI, which is an indicator of blood-raising potential of carbohydrates, in pulses is low as compared to other foods, and this is especially helpful to people who have diabetes (Rizkalla, Bellisle, & Slama, 2002). As an example, the GI of a bagel made out of white flour is 72, whereas the GI of lima beans is less than half, at 32 (Foster-Powell et al., 2002). This further demonstrates the superiority of pulses as compared to other foods.

The pulse-based foods in this study were found to be high in fibre as compared to the regular foods. Although dietary fibre is largely known for its ability to prevent or relieve constipation, it also helps in maintaining a healthy weight and lowering the risk of diabetes, some cancers, and heart disease (Carabotti, Annibale, Severi, & Lahner, 2017). In a Japanese study of 5,600 children aged 10-11 years, the investigators measured body weight and height, blood pressure, serum levels of total cholesterol, low- and high-density lipoprotein cholesterol and triglycerides (Shinozaki, Okuda, Sasaki, Kunitsugu, & Shigeta, 2015). The authors found that total fibre intake was correlated to a decreased risk of being overweight, having high total cholesterol, and a lower risk of high blood pressure. Similarly, in a Canadian longitudinal study of 448 students between the ages of 10 to 17 years followed for two years, it was found that their average fibre consumption was 15 g per day (Setayeshgar et al., 2016). The recommended

amount, however, is 38 and 25 g^{d-1} for men and women, respectively (Trumbo, Schlicker, Yates, & Poos, 2002). Pulses, therefore, are a superior source of fibre as compared to the regular meals offered to the children at the CCs.

Health Canada's DRI guidelines for fat do not stipulate the amounts that children, or adults, consume. Rather, the DRI guidelines suggest that total fat consumption for children over the age of four should contribute 25-35 percent of their daily total energy requirements (Health Canada, 2006). Generally speaking, the total energy expenditure of children in the 4-6 year old range group has been measured to be approximately 7871 kJ^{d-1} (E. J. Ball et al., 2001). Given that one gram of fat provides 9 calories (Durham, 2018), the pulse-based foods provided fewer calories as compared to the regular foods. The chickpea spread, as an example, provided 135 calories as compared to an average of 363 calories provided by the other dips (ranch and veggie) and cheeses (cream and cheddar) it replaced. A longitudinal study spanning six years followed the nutrient consumption levels of 95 children found that, on average, the children consumed 62.6 g of fat (Singer, Moore, Garrahie, & Ellison, 1995). The latter accounted for 33 percent of the children's daily caloric intake. In another study of dietary intake of children in a CC, the authors found similar results where fat intake accounted for approximately 31 percent of the children's caloric intake (Rasbold et al., 2016). In the chicken chickpea stir fry, the calories from fat accounted for 19 percent of the calories consumed. In the chicken stir fry, on the other hand, the percent of calories provided by fat was 14 percent. Unfortunately, there is no data of the daily total nutrition intake of the children. Therefore, the total daily fat consumption and its contribution to the daily caloric intake cannot be determined. Overall, however, the amount of fat in the pulse-based foods was lower than the foods it replaced.

In the case of saturated fats (SFs), overall, the pulse-based foods provided lower levels of SFs as compared to the regular meals. A number of health organizations, such as Health Canada (Government of Canada, 2019) and the WHO (World Health Organization, 2004) recommend reducing or limiting the amount of SFs in one's diet. The reason for limiting SFs, especially those derived from meat sources, is due the links between CVDs and high SF consumption (Kris-Etherton, Petersen, & Van Horn, 2018). It has been noted that by lowering the amount of energy derived from SFs by five percent can reduce the risk for coronary heart disease by 25 percent (Kris-Etherton et al., 2018). Meanwhile increasing the amounts of SFs derived from plant-based foods can decrease coronary heart disease by nine percent (Kris-Etherton et al., 2018). Moreover, a higher consumption of poly-unsaturated fatty acids improves glycaemia, insulin secretion capacity and insulin resistance (Imamura et al., 2016). Similarly, A moderate intake of plant and marine derived monounsaturated fats, along with a diet low in SFs reduce the risk of both cardiovascular diseases and cancers (De Lorgeril & Salen, 2012). In children, decreasing the intake of SFs has been shown to significantly reduce low density lipoprotein-cholesterol levels and diastolic blood pressure (Te Morenga & Montez, 2017). Also, one study found that children whose diets were higher in saturated fats and cholesterol exhibited a reduced ability to flexibly modulate their cognitive functions (Khan, Raine, Drollette, Scudder, & Hillman, 2015). Generally speaking, CCs provide higher levels of SFs then recommended (S. C. Ball, Benjamin, & Ward, 2008; Benjamin Neelon et al., 2012). Given the benefits of reducing SFs in one's diet, and besides being plant-based, pulses are generally superior to the regular foods served in CCs.

In terms of nutritional elements, the present study analyzed calcium, magnesium, potassium, sodium, zinc, and iron. Health Canada's DRI for the noted elements in children aged 4-8 are, in mg, 1000 (Ca), 130 (Mg), 3800 (K), 1200 (Na), 5 (Zn), and 10 (Fe) (Health Canada,

2010a). The levels of Ca, Mg, K, Na, Zn and Fe in the pulse-based foods were similar to those of the regular foods. The pulse-based foods would have provided a fraction of the DRI. As an example, the chicken chickpea stir fry, which contained 30 mg of Ca would have contributed only three percent of the DRI. The three bean quesadillas, with 215 mg of Ca, would have contributed approximately 25 percent of the DRI. The Ca, Mg, K, Zn and Fe levels in the pulse and regular meals are similar to one study which found that for lunch the children in 25 CCs received an average of 259 mg Ca, 65.9 mg of Mg, 3.8 mg Zn, and 2.8 mg of Fe (Rasbold et al., 2016). Similarly, in a study of 24 CCs in Georgia, the authors found the children were consuming approximately 690 mg of Ca and 6 mg of Fe over the course of a day (Maalouf et al., 2013). The preceding authors noted, however, that the levels of Na in the foods were higher than the DRI. This would have meant that over the course of a day the children would have consumed nearly twice the DRI of Na. Health Canada's tolerable upper intake levels (UL) for children between the ages of four to eight for Na is 1900 mg (Health Canada, 2010a). In the CCs studied in the present study, the levels of Na in some of the foods are very high. As an example, the veggie dip contained 820 mg while the pizza had 740 mg. Given that the DRI for Na is 1200, the consumption of just these two foods would mean that the veggie dip met 70 percent of the DRI while the pizza would account for 62 percent. With the consumption of other meals throughout the day, the children could very well be eating close to or more of the UL for Na. In any case, in the newest CFG, Health Canada has downplayed the importance of milk, dairy and meat as sources of nutritional elements and is recommending plant based foods such as vegetables, nuts, fruits, and legumes (Government of Canada, 2019). Given that for the present study, the levels of nutritional elements were only measured in one meal, it is likely that the children are consuming the DRI amounts of nearly all of these elements.

In terms of the vitamins C and folate, all of the foods differed greatly as to the amounts of vitamins consumed by the children. Health Canada's DRI for children between the ages of four to eight years old for vitamin C the DRI is 25 mg while the UL is 650 mg; for folate the DRI is 200 μg while the UL is 400 μg (Health Canada, 2010b). However, one cannot evaluate vitamin A data as they are in IUs and the UL is only for retinol, whereas the present data are in IUs that total both retinol and pre-vitamin A (from carotenes) (Berdanier & Berdanier, 2015). In terms of vitamin C, all of the regular and pulse-based foods, excepting the dips and cheeses, would have been sufficient to partially fulfill the DRI. In some cases, such as in the chicken chickpea stir fry with 43.2 mg vitamin C, it alone would have surpassed the DRI. As for folate, depending on the menu items offered to the children, on some days it would near fulfilling the DRI whereas on other days it would be insufficient. On a day when chicken wrap and the chickpea spread is provided, half of the DRI would have been met. However, on a day when chicken quesadillas (4.8 μg) and ranch dip (0 μg) is given to the children, they would have consumed only 2.5 percent of the DRI. It is unlikely that the cooks or the directors of the CCs are aware or regulating the menus according to the vitamin levels in the foods. The findings of the present study are similar to another study which found that in some cases vitamin C and folate exceeded the DRI guidelines on one day, met the DRI on a second, and were below the DRI on a third day (Rasbold et al., 2016). Regardless, due to constant changes of the menus and the foods the children are consuming, it is likely that over a week the children will have consumed their weekly levels of the vitamins required.

5.2 Plate Waste

Plate waste data provides information on the likes and dislikes of children and adults. Generally, the greater the plate waste the greater the dislike of a given food. The reason for the dislike can be due to a smell, texture, visual presentation, the lack of not being provided a certain food during childhood, other children influencing a child's behaviour, and even portion size (Dinis, Martins, & Rocha, 2013; Olsen et al., 2012; D. S. Ward, 2010). In the present study, plate waste was highly variable but generally, the food waste was greater for the pulse-based foods in each of the groups they replaced. Much (78.3%) of the ranch dip went uneaten, which was the highest leftover of all of the intervention and non-intervention foods. The beef tacos was the least wasted food (5.5%) followed by chicken quesadillas (9.5%). Amongst the pulse foods, the greatest wastage was for the chickpea spread (52%), followed by chicken chickpea stir-fry (47%), lentil pizza (38%) and the least wasted was the three-bean quesadilla (36%). Statistically, there was a significant difference in the plate-waste of chickpea spread and cream and cheddar cheese ($p < 0.05$). There was greater plate-waste of chickpea spread as compared to both cream and cheddar cheese, indicating that the children did not like the chickpea spread. Similarly, there was a significant difference between the chicken chickpea stir fry and the chicken parmesan and chicken stew. The difference was also significant for three bean quesadillas and beef tacos and chicken quesadillas. Overall, the children disliked the pulse-based foods. These significant differences may be attributed to the children not having eaten pulse-based foods in childhood, the texture or color of the food, or due to other children disliking the pulses. Children often mimic the behaviour of other children so that if a number of children dislike something, a child can be swayed, from a sense of shame or of not belonging to the group, to also dislike a given food (Stéphanie Ward et al., 2017). The mimicry can be towards foods, or any other activities a

child may perform, such as physical activity. The lack of having experienced the foods at home also plays a large role in children trying out a new food (Vedanthan et al., 2016). As well, a recent study found that food presentation in terms of its visual appeal, smell, variety of colors and texture also results in differences in the amount of food eaten and the amounts wasted (Olsen et al., 2012). This can include simple things such as food cut into cubes or sliced, or cut into decorative figures. It was found that the children preferred vegetables cut in figures over the other two types (Olsen et al., 2012). The qualitative interviews also revealed a striking feature in that all of the cooks noted that the children preferred the lentil pizza. However, their recollections were at odds with the actual amount of the lentil pizza that was not consumed by the children. More than a third of the lentil pizza was wasted, and this was higher than the regular pizza (29%), and the breakfast pizza (31%). The findings of the present study are similar to other studies where discarded foods of children were measured (Dinis et al., 2013; Thorsen et al., 2015). As an example, in one study of children attending grade one, it was found that food waste varied between different food types (Dinis et al., 2013). The authors found that more than half of fish related foods were discarded, 32 percent of meat-based foods, 65 percent of vegetables, and 24 percent of fruits. Regardless, plate waste data can be highly useful in determining the likes and dislikes of certain foods by children and adults.

5.3 Qualitative Discussion

The interview data was analysed and six key themes emerged: knowledge, or lack of, the CC food guidelines; length of time it took to cook the recipes; the effort in preparing the pulse recipes; price of the pulses; fatiguing the children with too many pulse-based foods; and the difficulty in having the kids eat the PDTK recipes.

With the exception of one cook, all of the people interviewed were familiar with the CFG and SCNG guidelines. They all understood that there were regulations they had to follow. However, it was also evident that they were mindful of the children's likes and dislikes of certain foods. They knew that if they offered a certain food, and most of it was not eaten, that they would be unlikely to offer that food again. This sensitivity by the CCs staff to the children is in line with the findings of other studies (Briley, Roberts-Gray, & Simpson, 1994; Quintanilha et al., 2013; Romaine, Mann, Kienapple, & Conrad, 2007). In one study, conducted at three CCs with differing ethnicities in Texas, the authors found that there were three main reasons why foods were offered to the children (Briley, Roberts-Gray, & Simpson, 1994). These were the regulatory requirements, the perceptions of the staff as to the children's food preferences, and the history of a given food program or regulatory guidelines at the centre. One of the suggestions by the authors on how to improve the foods offered to the children was to monitor the foods provided to the children. In the present study, a monitoring or a knowledge of the DRIs would likely have drastically changed the foods offered to the children.

The second theme the interviews uncovered was that time was a barrier to cooking the PDTK foods. Especially noteworthy was the fact that the directors at the CCs did not seem to appreciate or know that cooking time was a factor in the choices the cooks made as to what items appeared on the menus. The cooks noted that, besides the PDTK recipes being complex, it took a significant amount of time, as compared to the regular meals, to cook the PDTK foods. The cooks made a trade off in the sense that if the children liked a certain meal, they would continue to make a certain food even if it took them a little longer. As an example, the cooks and several directors noted that they did make lentil pizza after the intervention as they thought that the children liked them. However, the plate waste data is at odds with the perception of the cooks

and directors because, as compared to the regular and breakfast pizza, the lentil pizza had the highest plate waste. This means that the children preferred the regular pizzas as compared to the lentil pizza. Given that there is an average of 80 children at each CC, the chefs often make their decisions on what to cook with consideration towards the time it will take to cook a given meal. One of the cooks noted that she often had to prepare the PDTK foods the day before it was to be served. Moreover, two of the four directors thought time was a factor in cooking the PDTK meals, especially the dips. The directors' perception of time as a barrier may also have influenced the cooks to not adopt some of the PDTK recipes after the intervention. This finding, that time is a factor on the meals provided at a daycare is consistent with other studies (Seward et al., 2017). However, an earlier pilot study conducted at six rural CCs in Saskatchewan, where the author introduced pulse-based foods did find that the knowledge of the staff increased, in terms of pulses, due to the intervention (Chow, 2014).

The third theme the present study uncovered was that of the complexity of preparing the PDTK recipes. All of the cooks, but only one director thought that the recipes were too complex. The word complexity may be interchanged with the word impractical. In other words, due to there being only one chef, with no assistance, cooking for 80 children, besides time, it was impractical to make the PDTK recipes. In a survey study of 83 CCs conducted in Nova Scotia, 41 percent of the respondents noted that the menus had to be practical, or not be inordinately time consuming or complex (Mann, Power, & MacLellan, 2013). The same study found that besides being practical, 94 percent of the chefs felt that food selection was based on nutrition quality, 71 percent that foods meet government guidelines, and 41 percent that they be child friendly. Another point of note is how little the directors communicate, or appreciate, that for the

chefs it was impractical, or too time consuming, to make the PDTK recipes. Three of the directors did not think that the complexity of the recipes was an issue, but all of the chefs did. As one of the cooks opined that the PDTK recipes were "a lot, a lot, a lot of work. And then nobody is eating it."

Another thing, as the fourth theme, that CC staff have to consider is the costs of the meals they prepare and offer to the children. In the present study, three of the directors and none of the cooks thought that cost was a barrier to using pulse-based foods. Although one of the directors did note that cost and the availability of pulses was once a challenge, it no longer was as pulses were becoming more readily available. However, the lone director is mistaken as pulses are significantly less costly than meat with pulses often being considered to be a poor humans', or even a future superfood, due to its high protein and other nutrient content (Jayasena & Abbas, 2016). Although the food budget is an important consideration (Otten, Hirsch, & Lim, 2017), it generally is not as significant a factor as the likes and dislikes of the children and the nutrition quality of the foods offered to children at CCs. In a survey of 83 CCs in Nova Scotia, it was found that only 23 percent of the CCs considered cost as a factor in terms of what they offered the children (Mann et al., 2013).

The fifth theme uncovered through the interviews was the fear that providing too many pulse-based foods to the children might lead the children to become fatigued of pulses. In the present study, all of the cooks and directors noted that they changed their menus weekly so as to ensure that the children would be provided with a variety of meals. The rationale for this was that by becoming repetitive, this led to more plate waste. In the Nova Scotia study cited above, 60 percent of the 83 CCs reported that they revised their menus yearly while the remaining 40 had not revised their menus for a year or more (Mann et al., 2013). Besides children's preferences for

certain foods, other reasons for menu revisions, or the lack of, can include uncertainty with government guidelines, and lack of time. Alternatively, menus can change due to learning about the likes and dislikes of the children, budget changes, and the seasonality of certain foods. Studies have indicated that responsibility for menu planning in CCs generally lies with the cook and less so with the directors and parents (Mann et al., 2013; Pollard, Lewis, & Miller, 1999). The main reasons for the cooks being responsible for menu planning are to adhere to governmental policies, practicality or simplicity of cooking a given meal, and an awareness of what was eaten or not eaten by the children.

The last theme identified was difficulty in having the children eat the pulse-based foods. Besides preparation time and complexity of the recipes being difficult, the cooks and the directors voiced that they had trouble in getting the children to accept the pulse foods and that a significant amount of the pulse foods were wasted. The latter fact is borne out by the plate waste data as for the three main or larger course meals, the pulse foods were the foods that went uneaten. As the staff of the CCs pointed out, several reasons for this were: one, not being exposed to pulses at home and second, texture. In fact, there are many factors which may cause children to avoid or minimize the intake of certain foods. For one, many of the behaviors children learn, such as food preference and consumption, are influenced by their parents (Scaglioni et al., 2011; Scaglioni, Salvioni, & Galimberti, 2008; Vedanthan et al., 2016). Social factors such as wanting to fit in also play a factor. For example, children mimic the behavior of other children and if a number of children did not like the pulse-based food, other children who did like them would avoid the pulse food in order to fit in with the group. In a recent longitudinal study, the authors measured the changes in the physical activity and plate waste behavior in children (Stéphanie Ward et al., 2017). Over the nine months of the study, the authors found that

from the baseline, children who were more sedentary at the beginning, became more active as they associated with the other children. Similarly, the amount of plate waste decreased over the nine months (Stéphanie Ward et al., 2017). Moreover, food presentation in terms of shape, smell, color, texture, and visual appeal, results in differences in the amount of food eaten and wasted (Olsen et al., 2012). Lastly, food neophobia in children is where the latter avoid, or are reluctant to taste, foods that they are unfamiliar with (Dovey, Staples, Gibson, & Halford, 2008). In a study of children who were four to five years old, similar to children in the present study, it was found that the impacts of neophobia varies with food types (Cooke, Carnell, & Wardle, 2006). The authors of the latter study found that children who are more neophobic eat less vegetables, fruits, and protein foods as compared to children who were less neophobic. This neophobia, however can be overcome through repeat exposure to novel foods (Momin et al., 2018). Therefore, the factors associated with why the children left a large amount of plate waste of the pulse-based foods are varied and complex.

5.4 Strengths and Limitations of the Study

There are a number of strengths in the present study. First, using both qualitative and quantitative data improved the evaluation by ensuring that the limitations of one type of data are balanced by the strengths of the other. This allows a more comprehensive and contextual understanding of the PDTK intervention. The nutrient and plate waste data are objective and not self-reported and therefore cannot lead to any type of bias. The qualitative portion of the study allowed for a fuller understanding about the perceptions of the cooks and directors, and the reasons why the pulse-based recipes were not adopted by the CC staff. The fact that the staff found the recipes to be complex and time-consuming, and that the children did not like the pulse

foods, may lead to future refinements to the recipes. Undoubtedly, pulses, which are locally grown, inexpensive, and highly nutritious, may be introduced in other ways so that educators and children can grow accustomed to using and eating them.

However, as with any study, there are a number of limitations of the present work. First, the using of the food nutrient software may not be as accurate as doing an actual lab analysis for nutrient composition. Therefore, the nutrient data may not be precise. Second, the UL for vitamin A is only for retinol whereas our data are in IUs that total both retinol and pre-vitamin A. Therefore, the IU data cannot be evaluated using DRIs. Third, since the PDTK intervention was focused on replacing some of the lunch meals with pulses-based meals, the plate waste of many other meals was not collected. Fourth, the study makes the assumption that the children were all hungry and therefore the food that was refused or wasted was done due to taste only when in fact they may not have been hungry. Fifth, one of the reasons for non-adoption of the recipes by the cooks may have been due to time constraints. Sixth, the cooks may have altered the pulse-based recipes, and therefore the nutrient data may be incomplete. Lastly, for the interview data analysis, the present author's bias may have affected the themes that emerged.

5.5 Conclusion

This study examined the macro- and micronutrient content of pre and post-intervention regular and pulse-based meals served to 3-5 yo children at four Saskatoon CCs; the plate waste of the foods as a way to discover the foods the children liked and disliked; and also delved into finding factors which influenced the staff at the centres with continuing or discontinuing the use of the pulse-based foods. While the nutrient content of the pulse-based foods was often superior to the regular meal items, such as in the amount of fibre it offered, the children disliked the

pulse-based foods, as evidenced by the plate waste data. Additionally, the complexity of the pulse-based recipes was a major factor in the staff abandoning or discontinuing to use the recipes. The reasons for the children's dislike may have been due to not having been exposed to pulse foods before, the texture, color, taste, or smell of the pulse-foods.

5.6 Ideas for Future Research

One area for future research is to measure the actual amounts of macro and micro-nutrients the children actually consume in their meals. In the present study, the nutrient levels of the foods were measured but not the actual amount the children consumed. Taking the amount served, minus that wasted, and then calculating the actual amount of nutrients the children took in. This would lead us to understand if the children are actually consuming two thirds of their daily intake at the CCs.

Second, the actual consumption amount, averaged over a week or month, would provide evidence if the daily DRI for nutrients is low, being met, or high over the course of a week or a month.

Third, it should be investigated if the pulse-based recipes can be made less complex. Around the world, there are numerous ways that pulse foods are processed and cooked. If we want Canadians to eat more pulses, it would be advantageous to offer them recipes that are relatively simple and less time consuming.

Fourth, the present work has implications to policy and practice at CCs. With respect to policy and practice, there should be greater effort put in to ensure that the DRI of nutrients be such that they meet the reference guidelines. Presently, the DRI of some nutrients is being met

while for others it is not. Since foods are not prepared according to DRI standards, it is unknown if even on a weekly or monthly basis the children are consuming an average of their DRI.

Lastly, it should be further researched what it was about the pulse-based foods that the children did not like. Was it because they had not been introduced to them at home, the color, texture, smell, taste, or was it due to some children not liking them which then other children mimicked.

References

Akibode, S., & Maredia, M. K. (2012). Global and regional trends in production, trade and consumption of food legume crops: Department of Agricultural, Food, and Resource Economics, Michigan State University.

Anderson, A. R., & Jack, S. L. (2015). An introduction to the constant comparative. Handbook of Qualitative Research Techniques and Analysis in Entrepreneurship, 15.

Ball, E. J., O'Connor, J., Abbott, R., Steinbeck, K. S., Davies, P. S., Wishart, C., . . . Baur, L. A. (2001). Total energy expenditure, body fatness, and physical activity in children aged 6–9 y. The American journal of clinical nutrition, 74(4), 524-528.

Ball, S. C., Benjamin, S. E., & Ward, D. S. (2008). Dietary intakes in North Carolina child-care centers: are children meeting current recommendations? Journal of the American Dietetic Association, 108(4), 718-721.

Barbosa, R., Carvalho, C. G. d. N., Franco, V. C., Salles-Costa, R., & Soares, E. A. (2006). Food intake assessment of children attending a philanthropic daycare center in the Ilha de Paquetá, Rio de Janeiro, Brazil. Revista Brasileira de Saúde Materno Infantil, 6(1), 127-134.

Bazzano, L. A., Hu, T., Bertisch, S. M., Yao, L., Harville, E. W., Gustat, J., . . . Redline, S. (2016). Childhood obesity patterns and relation to middle-age sleep apnoea risk: the Bogalusa Heart Study. Pediatr Obes. doi:10.1111/ijpo.12103

Bélanger, M., Humbert, L., Vatanparast, H., Ward, S., Muhajarine, N., Chow, A. F., . . . Leis, A. (2016). A multilevel intervention to increase physical activity and improve healthy eating and physical literacy among young children (ages 3-5) attending early childcare centres: the Healthy Start-Départ Santé cluster randomised controlled trial study protocol. BMC Public Health, 16(1), 313.

Bendich, A., & Langseth, L. (1989). Safety of vitamin A. The American journal of clinical nutrition, 49(2), 358-371.

Benjamin Neelon, S. E., Vaughn, A., Ball, S. C., McWilliams, C., & Ward, D. S. (2012). Nutrition practices and mealtime environments of North Carolina child care centers. Childhood Obesity (Formerly Obesity and Weight Management), 8(3), 216-223.

Benton, D. (2010). The influence of dietary status on the cognitive performance of children. Molecular nutrition & food research, 54(4), 457-470.

Berdanier, C. D., & Berdanier, L. A. (2015). Advanced nutrition: macronutrients, micronutrients, and metabolism: CRC Press.

Berthon, B., & Wood, L. (2015). Nutrition and respiratory health—feature review. Nutrients, 7(3), 1618-1643.

Birch, L., Savage, J. S., & Ventura, A. (2007). Influences on the development of children's eating behaviours: from infancy to adolescence. Canadian journal of dietetic practice and research: a publication of Dietitians of Canada= Revue canadienne de la pratique et de la recherche en dietetique: une publication des Dietetistes du Canada, 68(1), s1.

Boston University School of Public Health. (2018). Diffusion of Innovation Theory. Retrieved from http://sphweb.bumc.bu.edu/otlt/MPH-Modules/SB/BehavioralChangeTheories/BehavioralChangeTheories4.html

Briley, M. E., Roberts-Gray, C., & Simpson, D. (1994). Identification of factors that influence the menu at child care centers: a grounded theory approach. Journal of the American Dietetic Association, 94(3), 276-281.

Brussoni, M., Gibbons, R., Gray, C., Ishikawa, T., Sandseter, E. B., Bienenstock, A., . . . Tremblay, M. S. (2015). What is the Relationship between Risky Outdoor Play and Health in Children? A Systematic Review. Int J Environ Res Public Health, 12(6), 6423-6454. doi:10.3390/ijerph120606423

Canadian Task Force on Preventive Health, C., Parkin, P., Connor Gorber, S., Shaw, E., Bell, N., Jaramillo, A., . . . Brauer, P. (2015). Recommendations for growth monitoring, and prevention and management of overweight and obesity in children and youth in primary care. CMAJ, 187(6), 411-421. doi:10.1503/cmaj.141285

Carabotti, M., Annibale, B., Severi, C., & Lahner, E. (2017). Role of fiber in symptomatic uncomplicated diverticular disease: a systematic review. Nutrients, 9(2), 161.

Chow, A. F. (2014). Healthy Start: An Evidence Based Intervention to Increase Physical Activity and Healthy Eating in Rural Childcare Centres. University of Saskatchewan.

Clark, H. R., Goyder, E., Bissell, P., Blank, L., & Peters, J. (2007). How do parents' child-feeding behaviours influence child weight? Implications for childhood obesity policy. Journal of public health, 29(2), 132-141.

Collins, C. E., Jane, W., & Burrows, T. (2009). Measuring dietary intake in children and adolescents in the context of overweight and obesity. International Journal of Obesity, 34(7), 1103. doi:10.1038/ijo.2009.241

Cooke, L., Carnell, S., & Wardle, J. (2006). Food neophobia and mealtime food consumption in 4–5 year old children. International Journal of Behavioral Nutrition and Physical Activity, 3(1), 14.

De Lorgeril, M., & Salen, P. (2012). New insights into the health effects of dietary saturated and omega-6 and omega-3 polyunsaturated fatty acids. BMC medicine, 10(1), 50.

Delimaris, I. (2013). Adverse effects associated with protein intake above the recommended dietary allowance for adults. ISRN nutrition, 2013.

Dinis, D., Martins, M. L., & Rocha, A. (2013). Plate waste as an indicator of portions inadequacy at school lunch. International Journal of Biological, Biomolecular, Agricultural, Food and Biotechnological Engineering, 7(7), 187-190.

Dovey, T. M., Staples, P. A., Gibson, E. L., & Halford, J. C. (2008). Food neophobia and 'picky/fussy'eating in children: a review. Appetite, 50(2-3), 181-193.

Durham, S. (2018). Going Nuts Over Calories. Agricultural Research, 66(3).

Durlak, J. A., & DuPre, E. P. (2008). Implementation matters: a review of research on the influence of implementation on program outcomes and the factors affecting implementation. Am J Community Psychol, 41(3-4), 327-350. doi:10.1007/s10464-008-9165-0

Erinosho, T. O., Ball, S. C., Hanson, P. P., Vaughn, A. E., & Ward, D. S. (2013). Assessing foods offered to children at child-care centers using the Healthy Eating Index-2005. Journal of the Academy of Nutrition and Dietetics, 113(8), 1084-1089.

Foster-Powell, K., Holt, S. H., & Brand-Miller, J. C. (2002). International table of glycemic index and glycemic load values: 2002. Am J Clin Nutr, 76(1), 5-56.

Frampton, A. M., Sisson, S. B., Horm, D., Campbell, J. E., Lora, K., & Ladner, J. L. (2014). What's for lunch? An analysis of lunch menus in 83 urban and rural Oklahoma child-care centers providing all-day care to preschool children. Journal of the Academy of Nutrition and Dietetics, 114(9), 1367-1374.

Freedman, D. S., Khan, L. K., Dietz, W. H., Srinivasan, S. R., & Berenson, G. S. (2001). Relationship of childhood obesity to coronary heart disease risk factors in adulthood: the Bogalusa Heart Study. Pediatrics, 108(3), 712-718.

Freedman, D. S., Khan, L. K., Serdula, M. K., Dietz, W. H., Srinivasan, S. R., & Berenson, G. S. (2005). The relation of childhood BMI to adult adiposity: the Bogalusa Heart Study. Pediatrics, 115(1), 22-27.

Glaser, B. G., & Strauss, A. L. (2017). Discovery of grounded theory: Strategies for qualitative research: Routledge.

Glasgow, R. E., Lichtenstein, E., & Marcus, A. C. (2003). Why don't we see more translation of health promotion research to practice? Rethinking the efficacy-to- effectiveness transition.(Author Abstract). The American Journal of Public Health, 93(8), 1261.

Goldsborough, N., Homer, C., Atchinson, R., & Barker, M. E. (2016). Healthy eating in the early years: A qualitative exploration of food provision in the childminder setting. British Food Journal, 118(4), 992-1002.

Gougeon, L. A., Henry, C. J., Ramdath, D., & Whiting, S. J. (2011). Dietary analysis of randomly selected meals from the Child Hunger and Education Program School Nutrition Program in Saskatchewan, Canada, suggests that nutrient target levels are being provided. Nutr Res, 31(3), 215-222. doi:10.1016/j.nutres.2011.03.002

Government of Canada. (2019). Canada's Food Guide. Retrieved from https://food-guide.canada.ca/en/

Government of Saskatchewan. (2008). Child care facilities menu planning form and menu checklist. In E. L. a. C. C. Ministry of Education, Nutrition Reference Group (Ed.).

Government of Saskatchewan. (2016). Child Care Licensee Manual. Retrieved from http://publications.gov.sk.ca/documents/11/87922-Child Care Licensee Manual.pdf.

Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., & Kyriakidou, O. (2004). Diffusion of innovations in service organizations: systematic review and recommendations. Milbank Q, 82(4), 581-629. doi:10.1111/j.0887-378X.2004.00325.x

Grol, R. (2013). Improving Patient Care : The Implementation of Change in Health Care (2). Somerset: Somerset, GB: Wiley.

Hae-Young, K. (2015). Statistical notes for clinical researchers: post-hoc multiple comparisons. *Restorative Dentistry & Endodontics, 40*(2), 172-176. doi:10.5395/rde.2015.40.2.172

Health Canada. (2006). Dietary Reference Intakes. Retrieved from https://www.canada.ca/en/health-canada/services/food-nutrition/healthy-eating/dietary-reference-intakes/tables/reference-values-macronutrients-dietary-reference-intakes-tables-2005.html

Health Canada. (2010a). Dietary Reference Intakes: Reference Values for Elements. Retrieved from https://www.canada.ca/en/health-canada/services/food-nutrition/healthy-eating/dietary-reference-intakes/tables/reference-values-elements-dietary-reference-intakes-tables-2005.html

Health Canada. (2010b). Dietary Reference Intakes: Reference Values for Vitamins. Retrieved from https://www.canada.ca/en/health-canada/services/food-nutrition/healthy-eating/dietary-reference-intakes/tables/reference-values-vitamins-dietary-reference-intakes-tables-2005.html

Health Canada. (2010c). Eating Well with Canada's Food Guide - First Nations, Inuit and Métis. Retrieved from https://www.canada.ca/en/health-canada/services/food-nutrition/canada-food-guide/eating-well-with-canada-food-guide-first-nations-inuit-metis.html

Health Canada. (2011). Dietary Reference Intakes Tables. Retrieved from https://www.canada.ca/en/health-canada/services/food-nutrition/healthy-eating/dietary-reference-intakes/tables.html

Health Canada. (2013). Eating Well with Canada's Food Guide. Retrieved from https://www.canada.ca/content/dam/hc-sc/migration/hc-sc/fn-an/alt_formats/hpfb-dgpsa/pdf/food-guide-aliment/view_eatwell_vue_bienmang-eng.pdf

Health Canada. (2016). Table of Daily Values. Retrieved from http://www.healthycanadians.gc.ca/eating-nutrition/label-etiquetage/regulatory-guidance-directives-reglementaires/daily-values-valeurs-quotidiennes/alt/daily-values-valeurs-quotidiennes-eng.pdf

Imamura, F., Micha, R., Wu, J. H., de Oliveira Otto, M. C., Otite, F. O., Abioye, A. I., & Mozaffarian, D. (2016). Effects of saturated fat, polyunsaturated fat, monounsaturated fat, and carbohydrate on glucose-insulin homeostasis: a systematic review and meta-analysis of randomised controlled feeding trials. PLoS medicine, 13(7), e1002087.

Jayasena, V., & Abbas, S. (2016). Pulses: Poor man's food or future super food? Food Australia, 68(3), 32.

Johnson, S. L. (2016). Developmental and environmental influences on young children's vegetable preferences and consumption. Advances in Nutrition, 7(1), 220S-231S.

Jha, S. K., McDermott, J., Bacon, G., Lannon, C., Joshi, P., & Dubé, L. (2014). Convergent innovation for affordable nutrition, health, and health care: the global pulse roadmap. Annals of the New York Academy of Sciences, 1331(1), 142-156.

Kakinami, L., Barnett, T. A., Séguin, L., & Paradis, G. (2015). Parenting style and obesity risk in children. Preventive medicine, 75, 18-22.

Katamay, S. W., Esslinger, K. A., Vigneault, M., Johnston, J. L., Junkins, B. A., Robbins, L. G., . . . Bush, M. A. (2007). Eating well with Canada's Food Guide (2007): development of the food intake pattern. Nutrition reviews, 65(4), 155-166.

Khan, N. A., Raine, L. B., Drollette, E. S., Scudder, M. R., & Hillman, C. H. (2015). The relation of saturated fats and dietary cholesterol to childhood cognitive flexibility. Appetite, 93, 51-56.

Kolasa, K. M. (2012). Healthy Eating, Healthy Weight for Kids and Teens. Journal of Nutrition Education and Behavior, 44(5), 472. e475.

Kris-Etherton, P. M., Petersen, K., & Van Horn, L. (2018). Convincing evidence supports reducing saturated fat to decrease cardiovascular disease risk. BMJ Nutrition, Prevention & Health, bmjnph-2018-000009.

Lakshman, R., Elks, C. E., & Ong, K. K. (2012). Childhood obesity. Circulation, 126(14), 1770-1779. doi:10.1161/circulationaha.111.047738

Leterme, P. (2002). Recommendations by health organizations for pulse consumption. British Journal of Nutrition, 88(S3), 239-242.

Maalouf, J., Evers, S. C., Griffin, M., & Lyn, R. (2013). Assessment of mealtime environments and nutrition practices in child care centers in Georgia. Childhood Obesity, 9(5), 437-445.

Maher, E. J., Li, G., Carter, L., & Johnson, D. B. (2008). Preschool child care participation and obesity at the start of kindergarten. Pediatrics, 122(2), 322-330.

Malav, O., Talukder, S., Gokulakrishnan, P., & Chand, S. (2015). Meat analog: a review. Critical reviews in food science and nutrition, 55(9), 1241-1245.

Mann, L., Power, D., & MacLellan, V. (2013). Development of Menu Planning Resources for Child Care Centres: A Collaborative Approach. Journal of Childhood Studies, 38(2), 34-40.
McCullum-Gomez, C., Barroso, C. S., Hoelscher, D. M., Ward, J. L., & Kelder, S. H. (2006). Factors Influencing Implementation of the Coordinated Approach to Child Health (CATCH) Eat Smart School Nutrition Program in Texas. Journal of the American Dietetic Association, 106(12), 2039-2044. doi:10.1016/j.jada.2006.09.016
Memon, S., Umrani, S., & Pathan, H. (2017). Application of constant comparison method in social sciences: a useful technique to analyze interviews. Grassroots, 51(1).
Mennella, J. A., Nicklaus, S., Jagolino, A. L., & Yourshaw, L. M. (2008). Variety is the spice of life: strategies for promoting fruit and vegetable acceptance during infancy. Physiology & behavior, 94(1), 29-38.
Mitchell, D. C., Lawrence, F. R., Hartman, T. J., & Curran, J. M. (2009). Consumption of Dry Beans, Peas, and Lentils Could Improve Diet Quality in the US Population. Journal of the American Dietetic Association, 109(5), 909-913. doi:10.1016/j.jada.2009.02.029
Momin, S. R., Hughes, S. O., Elias, C., Papaioannou, M. A., Phan, M., Vides, D., & Wood, A. C. (2018). Observations of Toddlers' sensory-based exploratory behaviors with a novel food. Appetite, 131, 108-116.
Mudryj, A. N., Yu, N., & Aukema, H. M. (2014). Nutritional and health benefits of pulses. Applied Physiology, Nutrition, and Metabolism, 39(11), 1197-1204.
Nanney, M. S., Johnson, S., Elliott, M., & Haire-Joshu, D. (2007). Frequency of Eating Homegrown Produce Is Associated with Higher Intake among Parents and Their Preschool- Aged Children in Rural Missouri. Journal of the American Dietetic Association, 107(4), 577-584. doi:10.1016/j.jada.2007.01.009
Navaneelan, T., & Janz, T. (2014). Adjusting the scales: Obesity in the Canadian population after correcting for respondent bias: Statistics Canada.
Nead, K. G., Halterman, J. S., Kaczorowski, J. M., Auinger, P., & Weitzman, M. (2004). Overweight children and adolescents: a risk group for iron deficiency. Pediatrics, 114(1), 104. doi:10.1542/peds.114.1.104
Needham, L., Dwyer, J. J., Randall-Simpson, J., & Heeney, E. S. (2007). Supporting healthy eating among preschoolers: challenges for child care staff. Canadian Journal of Dietetic Practice and Research, 68(2), 107-110.
Nicklas, T. A., Liu, Y., Stuff, J. E., Fisher, J. O., Mendoza, J. A., & O'Neil, C. E. (2013). Characterizing lunch meals served and consumed by pre-school children in Head Start. Public health nutrition, 16(12), 2169-2177.
O'Brien, H. T., Blanchet, R., Gagné, D., Lauziere, J., & Vézina, C. (2014). Prevalence of iron deficiency among Inuit preschool children attending childcare centres in Nunavik (632.8). The FASEB Journal, 28(1 Supplement), 632.638.
Olsen, A., Ritz, C., Kramer, L., & Møller, P. (2012). Serving styles of raw snack vegetables. What do children want? Appetite, 59(2), 556-562.
Otten, J. J., Hirsch, T., & Lim, C. (2017). Factors influencing the food purchases of early care and education providers. Journal of the Academy of Nutrition and Dietetics, 117(5), 725-734.
Pabayo, R., Spence, J. C., Casey, L., & Storey, K. (2012). Food Consumption Patterns: In Preschool Children. Canadian Journal of Dietetic Practice and Research, 73(2), 66-71.

Padget, A., & Briley, M. E. (2005). Dietary intakes at child-care centers in central Texas fail to meet Food Guide Pyramid recommendations. Journal of the American Dietetic Association, 105(5), 790-793.
Papanikolaou, Y., & Fulgoni, V. L. (2008). Bean Consumption Is Associated with Greater Nutrient Intake, Reduced Systolic Blood Pressure, Lower Body Weight, and a Smaller Waist Circumference in Adults: Results from the National Health and Nutrition Examination Survey 1999-2002. Journal of the American College of Nutrition, 27(5), 569-576. doi:10.1080/07315724.2008.10719740
Patterson, C., Maskus, H., & Dupasquier, C. (2009). Pulse crops for health. Cereal Foods World (CFW), 54(3), 108.
Peisner-Feinberg, E. S., Burchinal, M. R., Clifford, R. M., Culkin, M. L., Howes, C., Kagan, S. L., & Yazejian, N. (2001). The relation of preschool child-care quality to children's cognitive and social developmental trajectories through second grade. Child development, 72(5), 1534-1553.
Pollard, C. M., Lewis, J. M., & Miller, M. R. (1999). Food service in long day care centres--an opportunity for public health intervention. Australian and New Zealand journal of public health, 23(6), 606.
Prado, E. L., & Dewey, K. G. (2014). Nutrition and brain development in early life. Nutrition reviews, 72(4), 267-284.
Prasad, P. (2017). Crafting qualitative research: Beyond positivist traditions: New York: M. E. Sharpe, Inc
Pulse Canada. (2016). Pulse Industry. Retrieved from http://www.pulsecanada.com/pulse-industry
Quintanilha, M., Downs, S., Lieffers, J., Berry, T., Farmer, A., & McCargar, L. J. (2013). Factors and barriers associated with early adoption of nutrition guidelines in Alberta, Canada. Journal of Nutrition Education and Behavior, 45(6), 510-517.
Ramikie, R., & Haileslassie, H. (2017). Pulse Discovery Tool Kit Retrieved from http://www.theplusesofpulses.com/startingyoung/wp-content/uploads/2017/06/Pulses-Discovery-Tool-Kit.pdf
Rao, D., Kropac, E., Do, M., Roberts, K., & Jayaraman, G. (2016). Childhood overweight and obesity trends in Canada. Health promotion and chronic disease prevention in Canada: research, policy and practice, 36(9), 194.
Rasbold, A. H., Adamiec, R., Anderson, M. P., Campbell, J. E., Horm, D. M., Sitton, L. K., & Sisson, S. B. (2016). Macronutrient and micronutrient intakes of children in Oklahoma child-care centres, USA. Public Health Nutr, 19(8), 1498-1505. doi:10.1017/S1368980015002372
Rathbun, A., & Zhang, A. (2016). Primary Early Care and Education Arrangements and Achievement at Kindergarten Entry. NCES 2016-070. National Center for Education Statistics.
Rebello, C. J., Greenway, F. L., & Finley, J. W. (2014). Whole grains and pulses: a comparison of the nutritional and health benefits. Journal of agricultural and food chemistry, 62(29), 7029-7049.
Rizkalla, S. W., Bellisle, F., & Slama, G. (2002). Health benefits of low glycaemic index foods, such as pulses, in diabetic patients and healthy individuals. British Journal of Nutrition, 88(S3), 255-262.
Rogers, E. M. (2003). Diffusion of innovations (5th ed.). New York: Free Press.

Romaine, N., Mann, L., Kienapple, K., & Conrad, B. (2007). Menu planning for childcare centres: practices and needs. Canadian Journal of Dietetic Practice and Research, 68(1), 7-13.
Scaglioni, S., Arrizza, C., Vecchi, F., & Tedeschi, S. (2011). Determinants of children's eating behavior. The American journal of clinical nutrition, 94(6 Suppl), 2006S-2011S.
Scaglioni, S., Salvioni, M., & Galimberti, C. (2008). Influence of parental attitudes in the development of children eating behaviour. British Journal of Nutrition, 99(S1), S22-S25.
Setayeshgar, S., Ekwaru, J. P., Maximova, K., Majumdar, S. R., Storey, K. E., McGavock, J., & Veugelers, P. J. (2016). Dietary intake and prospective changes in cardiometabolic risk factors in children and youth. Applied Physiology, Nutrition, and Metabolism, 42(1), 39-45.
Seward, K., Finch, M., Yoong, S. L., Wyse, R., Jones, J., Grady, A., . . . Wolfenden, L. (2017). Factors that influence the implementation of dietary guidelines regarding food provision in centre based childcare services: a systematic review. Preventive medicine, 105, 197-205.
Sharma, S. V., Hedberg, A. M., Skala, K. A., Chuang, R.-J., & Lewis, T. (2015). Feasibility and acceptability of a gardening-based nutrition education program in preschoolers from low-income, minority populations. Journal of Early Childhood Research, 13(1), 93-110.
Shinozaki, K., Okuda, M., Sasaki, S., Kunitsugu, I., & Shigeta, M. (2015). Dietary fiber consumption decreases the risks of overweight and hypercholesterolemia in Japanese children. Annals of Nutrition and Metabolism, 67(1), 58-64.
Singer, M. R., Moore, L. L., Garrahie, E. J., & Ellison, R. C. (1995). The tracking of nutrient intake in young children: the Framingham Children's Study. American journal of public health, 85(12), 1673-1677.
Sinha, M. (2014). Spotlight on Canadians: Results from the General Social Survey–Child care in Canada. Canada, S., Ed. Statistics Canada: Ottawa, Canada.
Sommer A, & West K (2001). Vitamin A Deficiency: Health, Survival and Vision. NY, USA: Oxford University Press, Inc.
Stake, R. E. (2000). The art of case study research: Perspectives on practice (2nd ed.). Thousand Oaks, CA: Sage
Statistics Canada. (2012). Canadian Health Measures Survey: Cycle 2 Data Tables. doi:82-626-X
Statistics Canada. (2016). Population by sex and age group. Retrieved from http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/demo10a-eng.htm
Statistics Canada. (2017a). Directly measured physical activity of children and youth, 2012 and 2013. Retrieved from http://www.statcan.gc.ca/pub/82-625-x/2015001/article/14136-eng.htm
Statistics Canada. (2017b). Measured children body mass index (BMI) (World Health Organization classification), by age group and sex, Canada and provinces, Canadian Community Health Survey - Nutrition. Retrieved from http://www.statcan.gc.ca/daily-quotidien/170801/dq170801a-cansim-eng.htm
Sweitzer, S. J., Briley, M. E., & Robert-Gray, C. (2009). Do sack lunches provided by parents meet the nutritional needs of young children who attend child care? Journal of the American Dietetic Association, 109(1), 141-144.
Tandon, P. S., Zhou, C., & Christakis, D. A. (2012). The frequency of outdoor play for preschool age children cared for at home-based child care settings. Academic pediatrics, 12(6), 475-480.

Te Morenga, L., & Montez, J. M. (2017). Health effects of saturated and trans-fatty acid intake in children and adolescents: Systematic review and meta-analysis. PloS one, 12(11), e0186672.
Temple, V. A., Naylor, P.-J., Rhodes, R. E., & Higgins, J. W. (2009). Physical activity of children in family child care. Applied Physiology, Nutrition, and Metabolism, 34(4), 794-798.
Thompson, H. J., & Brick, M. A. (2016). Perspective: Closing the dietary fiber gap: An ancient solution for a 21st century problem. Advances in Nutrition: An International Review Journal, 7(4), 623-626.
Thorsen, A. V., Lassen, A. D., Andersen, E. W., Christensen, L. M., Biltoft-Jensen, A., Andersen, R., . . . Tetens, I. (2015). Plate waste and intake of school lunch based on the new Nordic diet and on packed lunches: a randomised controlled trial in 8-to 11-year-old Danish children. Journal of nutritional science, 4.
Tovar, J. (1996). Bioavailability of carbohydrates in legumes: digestible and indigestible fractions. Archivos latinoamericanos de Nutrición, 44(4 Suppl 1), 36S-40S.
Trumbo, P., Schlicker, S., Yates, A. A., & Poos, M. (2002). Dietary reference intakes for energy, carbohdrate, fiber, fat, fatty acids, cholesterol, protein and amino acids. Journal of the Academy of Nutrition and Dietetics, 102(11), 1621.
Tucker, P., van Zandvoort, M. M., Burke, S. M., & Irwin, J. D. (2011). Physical activity at daycare: Childcare providers' perspectives for improvements. Journal of Early Childhood Research, 9(3), 207-219.
Tveden-Nyborg, P., & Lykkesfeldt, J. (2009). Does vitamin C deficiency result in impaired brain development in infants? Redox Report, 14(1), 2-6.
Vandeweghe, L., Moens, E., Braet, C., Van Lippevelde, W., Vervoort, L., & Verbeken, S. (2016). Perceived effective and feasible strategies to promote healthy eating in young children: focus groups with parents, family child care providers and daycare assistants. BMC Public Health, 16(1), 1045.
Vedanthan, R., Bansilal, S., Soto, A. V., Kovacic, J. C., Latina, J., Jaslow, R., . . . Hajjar, R. (2016). Family-based approaches to cardiovascular health promotion. Journal of the American College of Cardiology, 67(14), 1725-1737. doi:10.1016/j.jacc.2016.01.036
Venn, B. J., Perry, T., Green, T. J., Skeaff, C. M., Aitken, W., Moore, N. J., . . . Bradshaw, A. (2010). The effect of increasing consumption of pulses and wholegrains in obese people: a randomized controlled trial. Journal of the American College of Nutrition, 29(4), 365-372.
Ward, D. S. (2010). Physical activity in young children: the role of child care. Medicine and science in sports and exercise, 42(3), 499-501.
Ward, S., Bélanger, M., Carrier, N., Vatanparast, H., Leis, A., & Donovan, D. (2016). A descriptive analysis of lunches served in New Brunswick and Saskatchewan childcare centres. Obesity Reviews, 17, 146-147.
Ward, S., Bélanger, M., Donovan, D., Boudreau, J., Vatanparast, H., Muhajarine, N., . . . Carrier, N. (2017). "Monkey see, monkey do": Peers' behaviors predict preschoolers' physical activity and dietary intake in childcare centers. Preventive medicine, 97, 33-39.
World Health Organization. (2004). Global strategy on diet, physical activity and health.
World Health Organization. (2015). Global Health Observatory Data. Retrieved from http://gamapserver.who.int/gho/interactive_charts/ncd/risk_factors/overweight/atlas.html
Yin, R. K. (2009). Case study research: Design and methods (4th ed.). Thousand Oaks, CA: Sage

Zhang, H., Zhang, T., Li, S., Li, Y., Hussain, A., Fernandez, C., . . . Chen, W. (2015). Long-term Impact of Childhood Adiposity on Adult Metabolic Syndrome Is Modified by Insulin Resistance: The Bogalusa Heart Study. Sci Rep, 5, 17885. doi:10.1038/srep17885

Appendix A: Saskatchewan Childcare Nutrition Regulations and Guidelines

The Child Care Regulations, 2015

PART III - **Standards for Facilities**	SUBJECT - **Nutrition**	PAGE 5-14
DIVISION 3 - **Health and Safety**		DATE February 12, 2016

SECTION 24

(1) Subject to subsection (3), a licensee must provide meals and snacks for children attending the facility who are six months of age or older.

(2) A licensee must ensure that:

(a) subject to subsection (3), the meals and snacks provided meet the nutritional needs of the children attending the facility; and

(b) the manner in which children are fed is appropriate to their ages and levels of development.

(3) Subject to subsection (4), a licensee is not required to provide:

(a) infant formula or baby food; or

(b) meals and snacks for a child who requires a special diet or whose parent requests a special diet.

(4) A licensee of a teen student support centre or a teen student support family child care home must provide any foods, other than infant formula, required by an infant under the age of six months.

22 May 2015 cC-7.31 Reg 1 s24.

INTENT

The intent of this section is to ensure:

- Meals and snacks provided meet the overall daily nutritional needs of children for the time they are in the licensed facility; and
- Children receive sufficient quality and quantity of foods at appropriate time intervals.

POLICY

Menus shall be prepared in advance and posted in a conspicuous location for the information of parents. A "conspicuous location" is an area accessible, highly visible, and frequented by parents.

A meal or snack shall be served within three hours of the facility opening each day and not more than three hours shall elapse between the provision of another meal or snack except during hours of care provided at night.

Where a facility provides child care services for a 24 hour period, the licensee shall ensure that where a child attends during the night, a meal is served to the child within one hour of waking in the morning.

Where a facility provides child care services to school-age children on school days, the licensee shall ensure:

- Where the child attends during the noon period, a meal is served to the child; and
- Where the child attends after school hours, a snack is served to the child within half an hour of return from school.

GUIDELINES

The current Canada's Food Guide *(refer to the Appendices)* is used as a guideline to determine adequate variety and amounts of foods from the four food groups for children over age two.

- Snacks consist of two or more food groups including a serving of vegetables or fruit plus at least one other food group in designated amounts.
- Breakfast consists of three or more food groups in designated amounts.
- All other meals consist of four food groups in designated amounts.
- Offer **milk** at least twice a day.
- If **juice** is offered:
  - It is 100% unsweetened juice
  - It is offered no more than 3 times per week
- Offer **water** for thirst.
- **Foods to limit**, if offered:
  - Appear on the menu no more than a total of 3 times per week.
  - Are in addition to the recommended food groups.

Refer to the Appendices for a sample "Menu Planning Form" and "Menu Criteria Backgrounder".

Names of children who have food allergies and the requirements due to the allergies are posted in cooking and food serving areas.

Children are encouraged, but not forced, to eat. Children can decide how much of the foods offered they want to eat.

No type of food is offered as a reward nor withheld as a punishment.

Dietary restrictions of families are followed although parents may be required to provide some of the special foods as outlined in 3(b) above.

Menus are planned and posted at least a week in advance.

Foods that are round, hard, small, thick and sticky, smooth, or slippery are not offered to children under 4 years of age unless modified to prevent choking. For example:

- Whole grapes are sliced lengthwise
- Wieners, if offered, are sliced lengthwise
- Pits are removed from fruit before serving
- Peanut butter is spread thinly

Feeding is handled to avoid waiting (e.g. children are seated at tables only once food preparation is complete; in homes, feeding of widely different ages can be staggered, such as feeding infants first while older children are engaged in other activities).

Infants & Toddlers

- Infants under six months are held by an adult during bottle feeding.
- Infants six months and over who are not capable of feeding themselves are held by an adult or seated in an infant seat or highchair during feeding, including bottle feeding.
- Where an infant is less than one year of age, the infant is fed by the same adult for more than half of the infant's feedings.
- Food for infants has the consistency and texture appropriate for developmental stage. Infants learning to eat solids will advance from puree to mashed foods. For older infants the maximum sizes of pieces is ¼ inch cubes.
- Food for toddlers is cut in pieces no larger than ½ inch cubes.
- Infants and toddlers are not put to bed with bottles. This reduces risk of choking, tooth decay and ear infection.

BEST PRACTICE

Eating is an enjoyable experience. Adults sit with children and encourage interaction and conversation about the concepts of colour, quantity and temperature of the food; eating behaviours; and events of the day.

Children are allowed to practice feeding themselves and are actively involved in serving food and other mealtime activities, such as setting and cleaning the table as their ages and abilities allow.

Child-sized utensils and serving dishes are used by children to make self-feeding easier.

Children are offered choices between nutritious alternatives, where feasible.

Menus include a variety of colours, flavours, textures, sizes, shapes and temperatures.

Parents of infants are encouraged to come to the facility to breastfeed or to bring expressed breast milk.

Appendix B: Pulse Intervention Recipes

Lentil Pizza

Preparation time: 30 minutes **Cooking time:** 30 minutes **Portion size:** 1 slice

Ingredients	Servings 8/10*		Servings 20*		Servings 50*		Direction
	Weight	Volume	Weight	Volume	Weight	Volume	
Pizza crust		8		20		50	
Red lentils	767.25g	3 cups	1,918.1g	7 ½ cups	4,795.3g	18 ¾ cups	Add the red lentils to the stock, and simmer, stirring regularly, until the lentils are very soft around 20 minutes. The lentils need to be stirred consistently as the stock gets absorbed to ensure they don't stick to the pan. Continue cooking until the mixture is fairly thick.
Vegetable stock	1,368.9g	5 ¼ cups	3,422.25g	13 ½ cups	8,555.6g	33 ¾ cups	
Pizza sauce	1,597.5g	6 cups	3,993.75g	15 cups	9,984.4g	37 ½ cups	Remove the mixture from the pan and place in a bowl. Add the pizza sauce and black pepper and stir the mixture well.
Black pepper	1.15g	½ tsp	2.9g	1 ¼ tsp	7.2g	1 TBSP	
Pineapple (prepackaged, not frozen)	87.4g	½ cups	218.5g	1 ¼ cups	546.25g	3 cups	Heat the oven to 350 ^{0} F. Spread 50 mL of the pizza sauce over each crust as a base, then place 100mL of the lentil mixture over the sauce. Add 250mL of mozzarella cheese over the lentil mixture. Dice the tomatoes, pineapples, and peppers. Place these onto the pizzas as toppings. Top this with 125mL more of cheese. Bake for 30 minutes until cheese is crispy.
Mozzarella cheese, shredded	1,419g	12 cups	3,547.5g	30 cups	8,868.75g	75 cups	
Heirloom or Roma tomatoes (diced)	738g	6	1,845g	15	4,612.5g	37.5	
Bell pepper (yellow, red, green)	476g	4	1,190g	10	2,975g	25	

*8-10 slices per pizza crust

Stir fried chicken, chickpea and vegetables

Preparation time: 1hour and 30 minutes **Cooking time:** 1 hour **Portion size:** 1/2 cup

Ingredients	Servings 8/10		Servings 20		Servings 50		Direction
	Weight	Volume	Weight	Volume	Weight	Volume	
Soy sauce	32.4g	2 TBSP	81g	¼ cups	202.5g	1/3 cups	In a large bowl, combine soy sauce and 15 mL corn starch. Pat chicken dry and cut into ½ inch chunks. Add chicken to soy sauce mixture and combine well.
Corn starch, divided	32.46g	¼ cup	81.15g	½ cups + 1 TBSP	202.9g	1 ½ cups	
Chicken breasts, boneless, skinless	1000 g	2.2lbs	2,500g	5.5lbs	6,250g	13.8lbs	
Chickpea, canned	380g	2 ½ cups	950g	6 ¼ cups	2,375g	15 ½ cups	In a separate bowl, combine stock, and the remaining corn starch. Heat vegetable oil in a large, deep non-stick skillet on medium-high heat. Add ginger and garlic. Cook for 30 seconds. Add chicken to the skillet and cook for a couple of minutes until lightly browned. Add chickpeas and 3 tbsp. of oil. Add red pepper, carrot, broccoli, and ¼ cup water. Cover and cook for 3-5 minutes or until chick is just cooked through and broccoli is bright green. Stir in reserved sauce well and add to chicken/vegetable mixture. Bring to a boil, stirring constantly. Taste and adjust seasonings if necessary. Serve sprinkled with cilantro.
Chicken stock	304.2g	1 cup + 3 TBSP	760.5g	3 cups	1,901.25g	7 ½ cups	
Vegetable oil	27.6g	2 TBSP	69g	¼ cups	172.5g	1/3 cup	
Fresh ginger root, finely chopped	11.7g	2 TBSP	29.25g	¼ cups	73.13g	1/3 cups	
Garlic, finely chopped	12g	4	30g	10	75g	25	
Red bell pepper, seeded and cut in strips	238g	2	595g	5	1,487.5g	12.5	
Carrot, thinly sliced	122g	2	305g	5	762.5g	12.5	
Broccoli, cut in 1 inch pieces	1,360.8g	2 bunches	3,401.9g	5 bunches	8,504.9g	12.5 bunches	
Cilantro	3.3g	3 TBSP	8.3g	½ cups	20.8g	1 ¼ cups	

Three bean quesadillas

Preparation time: 1 hour and 30 minutes **Cooking time:** 1 hour **Portion size:** 1 tortilla

Ingredients	Servings 8/10		Servings 20		Servings 50		Direction
	Weight	Volume	Weight	Volume	Weight	Volume	
Green lentils, cooked	209.25g	1 cup	523.13g	2 ½ cups	1,307.8g	6 ¼ cups	In a large skillet, heat oil over medium heat. Add pepper and onions. Sauté until soft and start to brown. Add in seasonings and sauté for another 30 seconds. Add pepper mixtures, beans, cooked lentils, and chickpeas. Lightly mash the pulse mixture to a chunky consistency. Then, stir to combine.
Kidney beans, canned	167g	1 cup	417.5g	2 ½ cups	1,043.75g	6 ¼ cups	
Chickpea, canned	152g	1 cup	380g	2 ½ cups	950g	6 ¼ cups	
Garlic cloves, minced	6g	2	15g	5	37.5g	12.5	
Chili powder	2.7g	1 tsp	6.75g	2 ½ tsp	16.9g	2 TBSP + ¼ tsp	
Cumin	1.05g	½ tsp	2.1g	1 tsp	5.25g	2 ½ tsp	
Vegetable oil	13.8g	1 TBSP	34.5g	2 ½ TBSP	86.25g	1/3 cup	
Jalapeno pepper, finely chopped	14g	1	35g	2.5	87.5g	6.25	
Red bell pepper, finely chopped	59.5g	½	148.75g	1.25	372.5g	3.13	
Large onion, finely chopped	75g	½	187.5g	1.25	469.5	3.13	
Tortillas	576g	8	1,440g	20	3,600g	50	To make quesadillas, spread about ½ cup of the pulse mixture over half of each tortilla. Then sprinkle about ¼ cup cheese and 1 Tbsp. cilantro over the lentil mixture. Fold empty half of tortilla over cheese and bean mixture. In skillet carefully place the quesadillas and cook about 3-4 minutes or until brown. Turn over carefully (the filling won't quite hold everything together yet), and brown the other side, making sure the cheese is melted throughout. Keep the quesadillas warm in an oven on a low heat while you continue to cook the others. Cut into 3 wedges and serve immediately.
Cheese, grated	236.5g	2 cup	591.25g	5 cups	1,478.13g	12 ½ cups	
Cilantro	1.0g	1 TBSP	2.5g	2 ½ TBSP	6.25g	1/3 cups	

Note: Cooking lentil. Rule of thumb for 1 cup of dry whole lentils, water needed: 2 ½ -3 cups. Cooking time: 20 minutes or less. Final yield: 2 ½ cups cooked. Alternative option: use the refried bean recipe instead of the pulse mixture

Chickpea Spread

Preparation time: 5 minutes **Portion size:** 2 tablespoons

Ingredients	**Servings 8/10**		**Servings 20**		**Servings 50**		**Direction**
	Weight	**Volume**	**Weight**	**Volume**	**Weight**	**Volume**	
Chickpea, drained and mashed	800g		2000g		5000g		In a medium bowl, combine chickpea, mayonnaise, relish, chopped spring onion, salt, and pepper. Mix well.
Mayonnaise	56g	¼ cup	116.7g	½ cups	350g	1 ½ cups	
Sweet pickle	30.4g	2 TBSP	60.8g	¼ cup	182.4g	¾ cup	
Spring onion, chopped	60g	4	150g	10	375g	25	
Salt and pepper		To taste		To taste		To taste	

Appendix C: Description of the PDTK Lesson Plan

Lesson	Title	Expected Outcome
Lesson1	Healthy Eating	Describe why food is important to our bodies Identify 4 different food groups & functions in CFG Recognize pulse as a part of CFG
Lesson 2	Meet Pulse	• Recognize familiar varieties of pulses & name 2-3 commonly used variety of pulses
Lesson 3	Pulse Buffet	• Children will become comfortable with tasting new foods such as different pulse dishes or snack in a supportive, positive environment
Lesson 4	Let Us Make Our Own Food	• Identify tools that will be used for cooking • Understand that beans are very versatile & prepared in a variety of ways • Understand that proper hygiene and safety that need to be followed during cooking
Lesson 5	Jamming to Pulse	• Identify food groups and the importance of each from each food group.
Lesson 6	It's Time to Germinate	• Describe the growth cycle • Students will be able to recognize how pulses are grown and the basic needs for growing pulses • Students will identify and recognize the different parts of plants that are edible • Germinate their own pulse
Lesson 7	It's Time to Grow Pulse	• Explain the benefits of growing pulses • Student will explore and be able to describe the difference between dry and wet soil • Describe why pulses are important to the body and explain other benefits beyond nutrition
Lesson 8	Pulse Snacks	• Make healthy snack with adult supervision • Explain the importance of snack
Lesson 9	Collage of Pulses	• Identify the different types of pulses
Lesson 10	Pulse Bowling	• Knowledgeable about physical activity and why it is important
Lesson 11	Let's Play Restaurant	• Identify pulse-based dishes in various setting • Improve communication skills when asking about pulses • Practice asking for pulses in various food setting
Lesson 12	Mystery Bucket	• Revise and identify different food groups • Explain the benefits of pulse as a part of health eating • Identify and state different pulses

Appendix D: Pre and Post-Intervention Nutrients Profile Comparison

Recipes	I* / R *	Energy (kcal)	Protein (g)	Carbohydrates (g)	Total Fibre (g)	Fat (g)	Saturated Fat (g)	Potassium (g)	Sodium (g)	Calcium (mg)	Iron (mg)	Magnesium (mg)	Zinc (mg)	Folate-DFE (µg)	Vitamin C (mg)	Vitamin A (IU)
Chicken Chickpea Stir-Fry	I	85	10.5	6.9	1.96	1.83	0.27	0.24	0.14	30	0.7	19.5	0.49	33.8	43.2	1564
Chicken Stir-Fry	R	86	11.1	4.5	1.16	2.47	0.43	0.28	0.53	28	0.6	13.7	0.62	9.7	14.9	10
Chicken Stew	R	119	12.7	13.3	1.21	1.33	0.38	0.44	0.10	10	0.9	23.9	0.60	8.8	10.4	124
Chicken Parmesan	R	173	14.9	10.5	1.49	7.54	3.28	0.24	0.44	132	1.0	22.5	0.95	9.3	1.1	499
Three Bean Quesadillas	I	224	9.9	27.1	4.95	8.97	4.11	0.14	0.41	215	2.0	17.4	0.96	49.0	6.6	389
Chicken Wrap	R	175	7.4	17.9	2.80	8.55	2.15	0.15	0.33	76	1.4	9.0	0.20	57.7	1.8	3701
Beef Tacos	R	240	17.7	22.9	3.20	9.03	3.25	0.27	0.35	21	2.8	39.5	4.01	19.5	0.9	126
Chicken Quesadillas	R	294	12.8	36.3	4.74	11.43	4.54	0.01	0.60	197	2.2	4.8	0.65	4.8	2.1	221
Beef Quesadillas	R	281	18.3	21.9	2.84	13.43	5.30	0.17	0.34	130	2.5	13.0	3.24	7.0	0	142
Chickpea Spread	I	135	6.2	21.4	5.62	3.21	0.36	0.12	0.45	44	1.0	22.4	0.54	39.0	1.3	105
Ranch Dip	R	398	3.3	5.0	0	39.77	4.97	0	0.62	66	0	0	0	0	0	0
Veggie Dip	R	484	1.0	6.7	0.70	51.39	8.02	0.06	0.82	31	0.6	5.0	0.40	4.0	3.4	38
Cream Cheese	R	350	6.2	5.5	0	34.44	20.21	0.13	0.31	97	0.1	9.0	0.50	9.0	0	1111
Cheddar Cheese	R	393	21.4	0	0	35.71	21.43	0	0.61	714	0	0	0	0	0	1071
Lentil Pizza	I	142	8.7	13.8	2.54	5.83	3.33	0.24	0.24	144	1.0	11.3	0.59	7.6	17.2	259
Pizza	R	213	10.7	14.8	1.53	12.64	6.09	0.18	0.74	106	1.9	27.3	1.13	16.4	5.0	567
Breakfast Pizza	R	204	12.0	6.3	0.29	14.22	6.03	0.12	0.28	195	1.0	13.5	1.42	29.2	0.1	655

Appendix E: Childcare Directors/Cooks Interview Questions
Childcare Directors/Cooks Semi-Structured Interview

Childcare Centre:

Name: Position:

1. Are you aware of the food provision guidelines for childcare centres in Saskatchewan and Canada?
2. How often do you include pulse-based dishes in your menu?
3. Have you prepared pulse-based dishes at this facility after our intervention?
4. Did you continue to include any of our intervention recipes in the menu? (Yes or No) If Yes, when were these recipes added during the last year?
5. What are the opportunities/hindrances to including pulse-based dishes? Please explain.
6. What are the benefits in cooking pulse-based dishes within your facility? Please explain, including the costs and cooking time?
7. What were the barriers to cooking pulse-based foods?
8. Which recipes from the intervention did you keep cooking?
9. Did the children like the taste of the pulse-based dishes in our intervention? Please explain your answer.
10. Did the PDTK provide you the opportunity to cook more pulse-based food in your school?

Many Thanks for taking the time to complete this interview process.

Appendix F: Time Line for the Research Program

Year	Fall 2016/2017			Fall 2017/2018			Fall 2018/2019		
Term	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**	**T1**	**T2**	**T3**
Can Academic Acclturation GSR 981									
PDTK Intervention Research Assistance-Phase III									
Research Methods NUTR 305									
Introduction to Systematic Review & Meta Analysis- Johns Hopkins University									
Teaching Assistance-Food, Culture, & Human Nutrition 310									
Ethics and Integrity in Human Research GPS 961									
Philosophy & Practice of University Teaching GSP 989									
Biostatistics I CHEP 805									
Advances in Public Health Nutrition Research NUTR 811									
Seminar									
Planning of the Research Proposal									
Writing Research Proposal (this has been adjusted in September 2017)									
Objective 1									
Objective 2									
Objective 3									
Writing Results Chapter									
Writing Discussion Chapter									
Permission to Write									
Thesis Defence									

T1: Sept-Dec, T2: Jan-Apr, T3: May-Aug